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On Page 50

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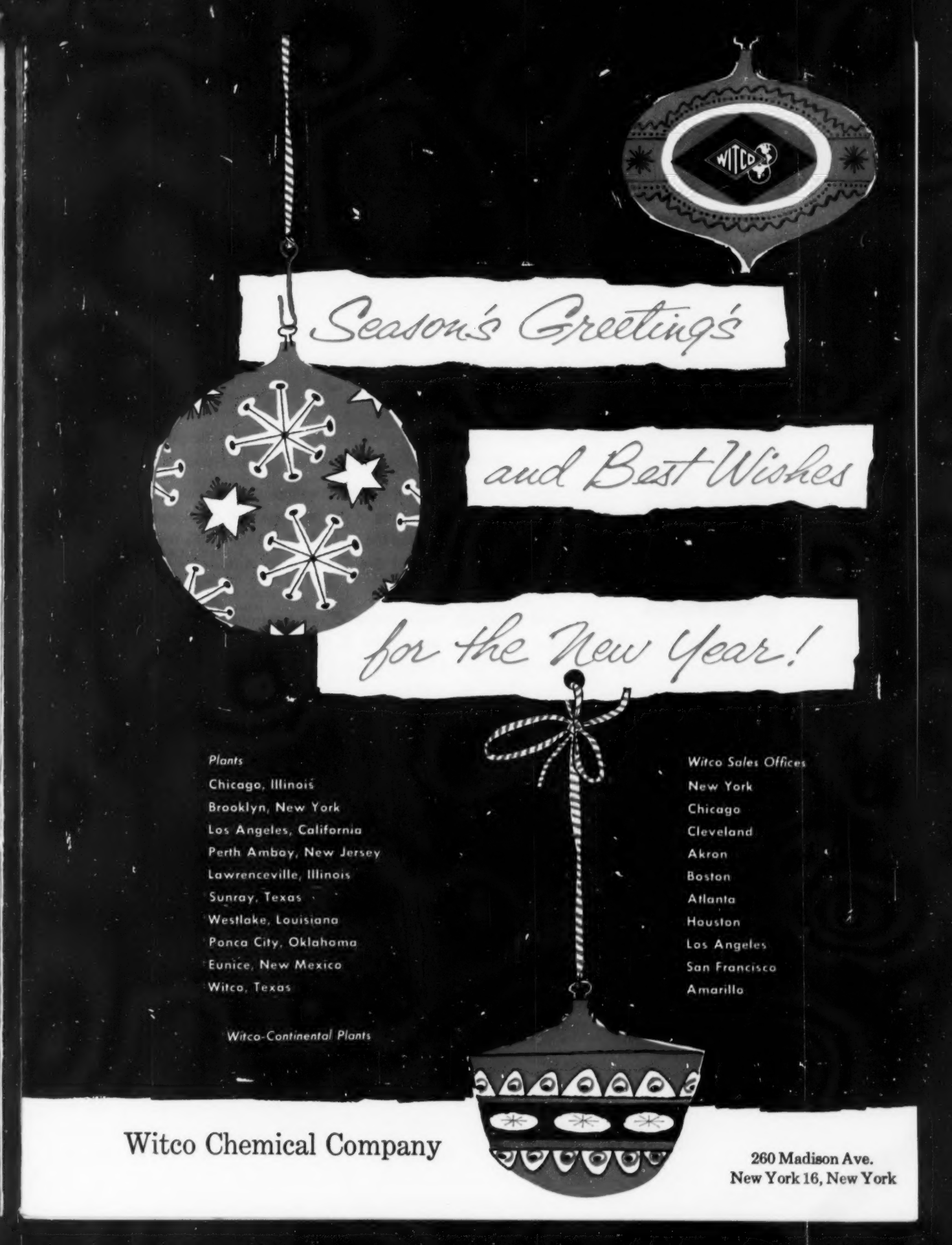
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President's page

by H. L. HEMMINGWAY, President, N L G I

PROGRESS!

Dramatic evidence of the progress made by NLGI and the grease industry was presented at our Annual Meeting in San Francisco.

An outstanding example of the lubricating grease industry's scientific advance, and the sharing of this progress with NLGI Membership was the Panel Discussion led by L. C. Brunstrum on the afternoon of October 25, "Studies of Grease Structure—A Basis for New Developments."

This panel discussion, and a couple of questions put to the panel by an old friend, and contributor to NLGI programs, Mr. H. R. Wolf of General Motors Research, reminded us of an incident that took place some years ago at an annual meeting in Chicago. This may have been the last pre-war meeting held at the Stevens Hotel, now the Conrad Hilton.

While memory fails to indicate what started the discussion, we distinctly remember Mr. Wolf's urging to a small group of us after that meeting that the grease industry should do more really fundamental research on grease structure, manufacture, and application.

The blue ribbon international group of five panel leaders at San Francisco—none with less than a Doctor's degree—and the many panel contributors proved that the lubricating grease industry has come a long way in research on the most basic, most fundamental study of all—the actual physical structure of the product it sells, lubricating grease.

A word of gratitude here, too, for all the others who contributed their time and effort to the 1954 Annual Meeting Program, and especially to 1954 President Fred Olsen, and to Wayne Goodale, whose special efforts demonstrated the meaning of California hospitality.

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by H. L. Hemmingway, The Pure Oil Company

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ABOUT THE COVER

Artist Ronald Jones looked over the large assortment of pictures taken of the NLGI Annual Meeting and presented to us by the Standard Oil Company of California. Sure, he knew how to illustrate a meeting. Fact was, he had attended some himself.

His idea of a meeting turned out to be: people; a microphone; gavel; and something that looks like a report. To further confuse the whole thing he added a holiday atmosphere by slashing it up with green and red.

Now that you have his explanation of the illustration we hope you'll agree that it is a bit unusual.

ESTERSILS

A New Class of Thickening Agents

G. C. Meyer
R. O. Braendle
E. I. du Pont de Nemours & Co. (Inc.)

PRELIMINARY STUDY OF ESTERSILS

The selection of an optimum estersil grease thickener presented a complex problem. It involved choosing the material to be esterified, the kind of ester coating, and the amount of coating to be applied. Such variables in estersil composition had inter-related effects upon both thickening properties and ease of estersil preparation. A summary of typical results of the preliminary work, showing some of the considerations involved in selecting the preferred product, is believed to be of general interest.

Variables in Estersil Composition

The primary variable in estersil composition is the type of substrate to which the ester coating is applied. The substrates can be insoluble metal silicates such as clays, insoluble metal silicates coated with amorphous silica, or simply amorphous silica.[1] This discussion, however, will be eliminated to estersils of amorphous silica, the substrate selected for major investigation.

The estersils made from amorphous silica were generally white powders with bulk densities ranging from 0.05 to 0.45 grams per milliliter. Preferred products, however, are produced in the form of readily pulverable granules or pellets to facilitate handling and storage.

The substrates of these estersils are sponge-like aggregates of extremely small ultimate particles of amorphous silica. As indicated in Figure 2, the ultimate par-

Continued on page 10

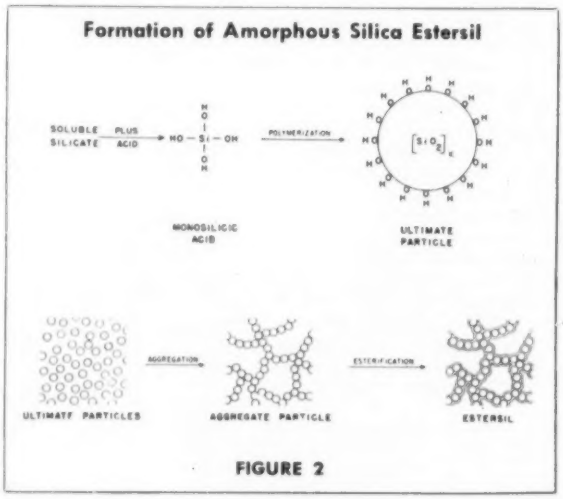

FIGURE 2

INTRODUCTION

SEVERAL YEARS AGO, it was discovered by R. K. Iler* that the surfaces of certain finely-divided siliceous solids could be chemically reacted with primary or secondary alcohols (Figure 1) to make these solids highly water repellent and oil wettable.[1] The new compositions were called "estersils" since the surfaces were covered by groups (SiOR) analogous to the linkages in silicic esters.

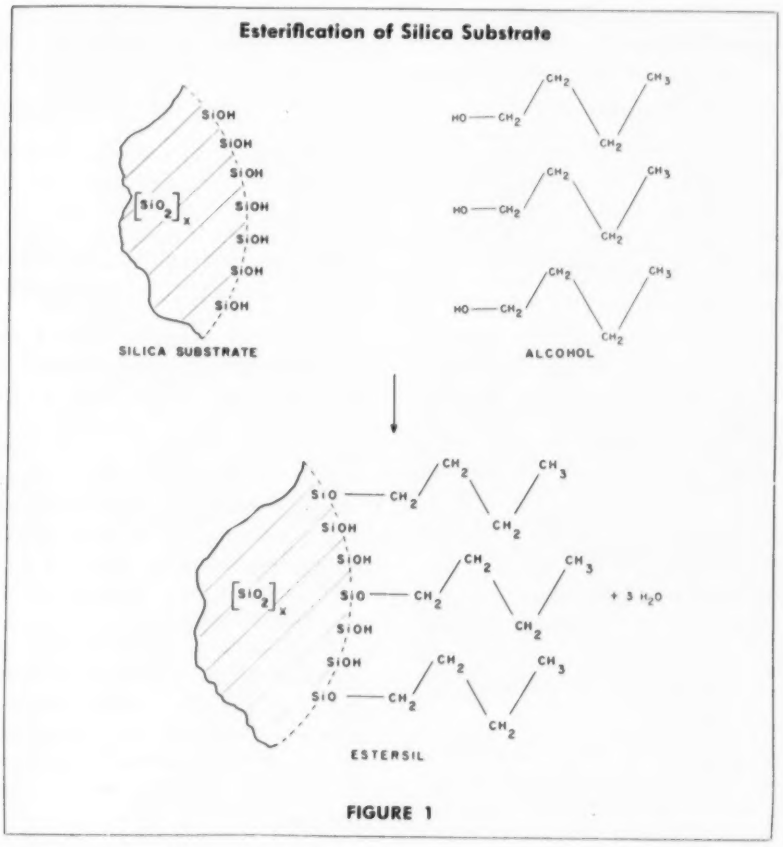

FIGURE 1

The use of estersils as thickening agents for lubricating greases[2] appeared particularly attractive because the hydrophobic, chemically-reacted surface coating imparted excellent resistance to the separation of the thickener in the presence of water. Such separation is a serious disadvantage of greases thickened with uncoated siliceous solids.

This paper summarizes the results of a laboratory investigation of estersil greases. It is divided into two parts—first, a discussion of preliminary work leading to the selection of a preferred estersil grease thickener, and second, a description of the preparation and properties of greases containing the preferred product.

*Grasselli Chemicals Dept., E. I. du Pont de Nemours & Co. (Inc.), Wilmington, Delaware.

ticles, spherical in shape, can be formed by the polymerization of monosilicic acid, a very reactive intermediate produced by neutralizing a soluble silicate with a strong acid. Polymerization can be controlled to obtain relatively uniform particles in the diameter range from 5 to 100 millimicrons. These ultimate particles are, in turn, joined together through a second polymerization reaction to form the three-dimensional, sponge-like aggregates which are thousands of millimicrons in diameter. The surface of all silica particles in the aggregates can then be esterified to varying degrees. When the surface-esterified silica is milled with oil, these relatively large aggregates are broken down to much smaller fragments, approaching colloidal dimensions. These sub-microscopic sponge-like units form the thickening structure of the grease.

Variables in the composition of estersils employing amorphous silica as the substrate include, therefore:

1. Size of ultimate spherical particles.
2. "Structure" or arrangement of ultimate particles in the aggregates.
3. Completeness of esterification of the surface.
4. Kind of esterifying agent.

The ultimate particle size can be observed with the electron microscope or calculated from the specific surface area as measured by nitrogen adsorption,[3] since the specific surface area varies inversely with ultimate particle size. Methods for characterizing the "structure" or manner in which the ultimate particles are joined together are quite complex and involve measurements which reflect not only the geometry of the three-dimensional network of ultimate particles in the aggregates, but also the way in which the ultimate particles are linked together.

The completeness of esterification is determined by the ester content and surface area of the estersil. It is conveniently described in terms of the number of ester groups per 100 square millimicrons of silica surface. This number will be called the Degree of Esterification, or simply D.E., and can be calculated from an expression given in reference (1), knowing the kind of esterifying agent, carbon content of the estersil, and surface area of the substrate.

TABLE I

Esterifying Agent Affects Thickening Power and Water Resistance

Alcohol Used	*SiO_2 in Estersil*	*Yield Index**	*Water Resistance of Grease Life at 120°F., 100% RH*
Ethyl	89.4%	11.1	18 days
iso-Propyl	89.0%	12.6	125 days
n-Butyl	85.3%	16.0	Over 150 days
Lauryl	——	30.0	Over 150 days
Stearyl	70.9%	28.8	Over 150 days

*Per cent estersil for grease of given penetration.

Effect of Esterifying Agent

The effect of the alcohol used for esterification upon thickening power of the estersil and water resistance of the estersil grease is illustrated in Table I. All estersils in this group were prepared from the same amorphous silica substrate, which had a nitrogen surface area of approximately 300 square meters per gram. In each case esterification was carried out to the maximum practical degree, corresponding to Degrees of Esterification in the range of from 300 to 400.

TABLE II

Degree of Esterification Affects Thickening Power and Water Resistance

Degree of Esterfication	*Yield Index**	*Water Resistance of Grease Life at 120°F., 100% RH*
231	12.2	25 days
313	13.0	130 days
387	15.0	Over 150 days

*Per cent estersil for grease of given penetration.

The thickening power is indicated in terms of an arbitrarily chosen Yield Index, which is the approximate weight per cent of estersil required to thicken a given Mid-Continent solvent treated oil (viscosity 300 SUS at 100°F., VI 96, API Gravity 28.8) to a worked Kaufman micropenetration of 82 when the estersil and oil are premixed manually at room temperature and then passed seven times through a 3-roll ink mill set at a clearance of 0.0015 inches. Thus, the lower the Yield Index, the better the thickening power.

It will be seen that Yield Index increases with increasing chain length of alcohol. The relatively good thickening power of the estersils made with shorter chain alcohols, indicated by low Yield Index, can be attributed in part to the increased weight percentage of silica in the estersil. However, other factors also appear to be involved.

Resistance to disintegration by water was observed by coating 2 x 4 x ⅛ inch steel test panels with a 1/16 inch layer of grease and exposing these, in a vertical position, in a humidity box maintained at 120°F., 100% relative humidity. Failure was indicated when the leaching action of the condensed water caused sufficient separation of thickener and oil to leave white patches of substantially oil-free silica upon the surface of the grease.

The superior water resistance of greases thickened with estersils containing ester groups of four carbon atoms or more indicate a greater stability toward hydrolysis on the part of these longer chain coatings.

From data such as these and practical processing considerations,[1] n-butyl alcohol was selected as the most promising esterifying agent for further study.

TABLE III

Esterification Improves Thermal Stability

Degree of Esterfication	*Change in NLGI Grade of Grease in 4 days at 300°F.*
75	1.3 soften
313	0.3 harden

Effect of Degree of Esterification

Some effects of the Degree of Esterification are indicated in Table II. An amorphous silica substrate having a surface area of about 300 square meters per gram was esterified to varying degrees with n-butyl alcohol, the individual samples being made into grease and tested as previously described.

It will be seen that as the D.E. is increased, Yield Index increases, indicating reduced thickening power, while water resistance of the grease is improved. Accordingly, considering these data alone, a compromise might be indicated.

Several theories could be advanced to explain the increasing thickening power with decreased amount of surface coating. One explanation assumes that the unesterified hydroxyl or silanol groups present on the silica surface contribute to the thickening effect by "cross linking" silica aggregates through a hydrogen bonding mechanism similar to that postulated for certain soap thickeners. If this is so, thickening power would be increased by leaving some hydroxyl groups uncovered.

In addition to providing water resistance, application of the ester coating also helps overcome another problem sometimes encountered with inorganic greases—excessive softening upon working after elevated temperature exposure.[4] This property of greases can be observed by exposing 5 to 10 gram portions of grease for a few days at 300°F., cooling to room temperature, working vigorously with a spatula, and then determining consistency. As shown in Table III, considerable softening of the grease took place when a silica substrate esterified to a low degree was used, while an estersil of high D.E. prepared from the same substrate gave a grease which actually hardened somewhat.

Surface Area Affects Thickening Power

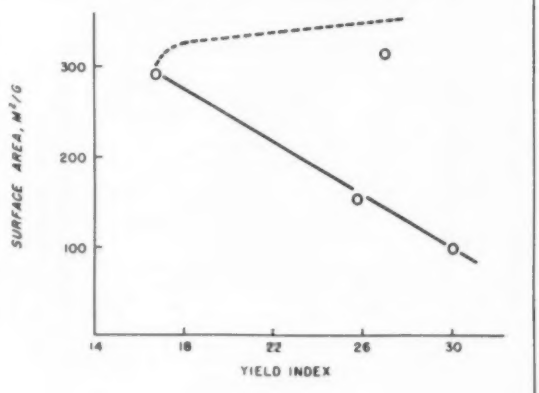

FIGURE 3

Effect of Ultimate Particle Size

Decreasing the ulticate particle size, as indicated by increasing specific surface area, generally improves estersil thickening power. As shown in Figure 3, covering data on a series of n-butyl estersils prepared under similar conditions, Yield Index was observed to decrease with increasing surface area up to a certain point. Beyond this point products of increasing surface area became more difficult to maintain in an easily dispersible state.

Amorphous silica estersils probably thicken oils largely by immobilizing the oil in the pores of the sponge-like aggregates. Therefore, the beneficial effect of smaller silica particles probably arises from the fact that a smaller weight of silica is required to form a given volume of sponge-like aggregates.

Effect of "Structure"

Estersils having similar surface area and esterified to the same degree with a given alcohol can still display widely varying thickening power. This variation is due to differences in "structure" or the way in which the ultimate particles are linked together. Data on a series of n-butyl estersils showing the effect are given in Table IV.

As illustrated, the "structure" variation among these products is believed to arise largely from differences in the packing of the ultimate units within the sponge-like aggregate. This conclusion is based on independent measurements of pore volumes of estersils and knowledge of the variables controlled during substrate formation. The beneficial effect of the more "open" structure can be explained on the basis that it holds more oil for a given weight of thickener.

These data emphasize again that it is not possible to take advantage of the increased thickening power inherent in small ultimate particles without consideration of the "structure." Since, in general, it is more difficult to obtain an "open" structure as ultimate particle size decreases, a compromise between these factors must be sought.

TABLE IV

"STRUCTURE" AFFECTS THICKENING POWER

"STRUCTURE"	SURFACE AREA	DEGREE OF ESTERIFICATION	YIELD # INDEX
"OPEN" PACKING	275 M^2/G	315	13.5
"INTERMEDIATE" PACKING	268	360	16.2
"CLOSE" PACKING	275	350	23.2

PERCENT ESTERSIL FOR GREASE OF GIVEN PENETRATION

EVALUATION OF PREFERRED ESTERSIL

TYPICAL PROPERTIES of the preferred estersil selected for detailed laboratory evaluation are given in Table V. Figure 4 is an electron micrograph of the preferred product, showing the ultimate spherical particles joined into sponge-like aggregates.

TABLE V

Typical Properties of Preferred Estersil

Appearance	White granular solid
Ultimate particle size, millimicrons	8–10
Surface Area by nitrogen adsorption, m2/g	300
"Structure"	"Open"
Esterifying Agent	n-Butyl Alcohol
Degree of Esterification, butoxy groups/100 sq. millimicrons	340
SiO_2, wt. per cent	88.5
Water-soluble, non-siliceous ash, sulfated, wt. per cent	0.14
pH in 50–50 methanol-water mixture	8.6
Bulk Density, g/ml.	0.25

Grease Preparation

Estersil greases are made by an entirely mechanical process which involves mixing the thickener with oil and passing the mixture through a mill capable of developing high shear rates. The greases to be described were prepared with three models of the Gaulin Homogenizer—a 25 gph laboratory model with a single-piston pump and commercial models of 30 and 100 gph capacity with three-piston pumps. These machines are essentially high pressure pumps discharging through a pressure release valve which produces the high turbulence and the strong shearing forces required to disperse the estersil adequately throughout the oil. Premixes of oil and estersil were stirred at 150 to 175°F. for one to two hours to assist in the separation of air trapped within the estersil granules, since entrained air complicates operation of the homogenizer. The greases obtained were buttery and transparent, with the color and bloom of the oil from which they were made. The yield of grease was found to depend upon the pressure drop across the release valve, the number of passes through the homogenizer, the model of the homogenizer, and the viscosity and type of the oil used.

Electron Micrograph of Preferred Estersil

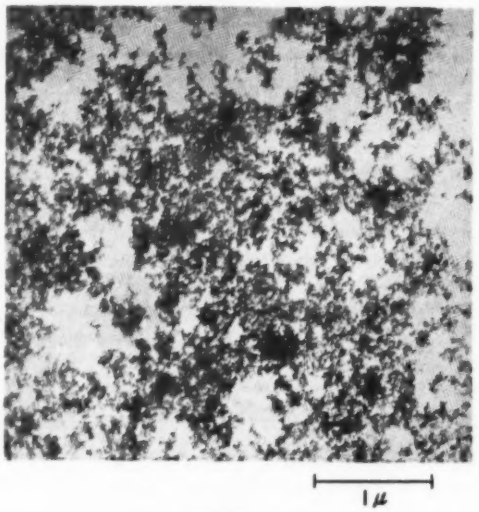

FIGURE 4

Increasing the pressure drop across the pressure release valve of the homogenizer was found to increase yield, as illustrated by the examples shown in Figure 5. These greases were prepared with two different oils and various estersil concentrations, using the 30 gph homogenizer at pressure drops of 5000 and 8000 psi. The worked ASTM penetrations are plotted in Figure 5 against the reciprocal of the thickener concentration to obtain straight lines which are convenient for yield comparisons.

Pressure Drop in Homogenizer Affects Yield

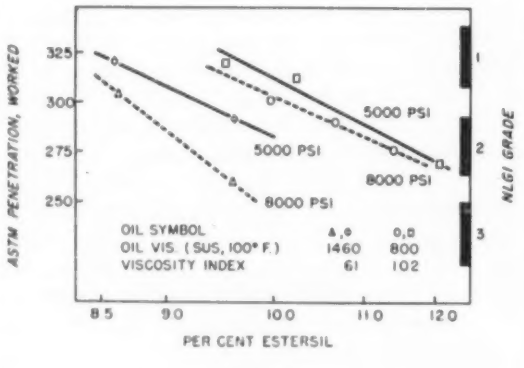

FIGURE 5

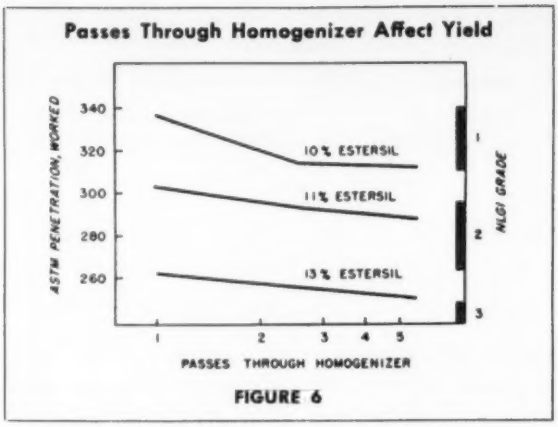

FIGURE 6

With these particular oils, from 5 to 10 per cent less thickener was required at the high pressure drop, apparently because of greater turbulence in the shear unit.

Figure 6 shows the effect of additional passes through an homogenizer on grease consistency observed when operating the 30 gph machine with a pressure drop of 8000 psi. It will be seen that there was very little increase in yield after the second pass, particularly with the heavier greases. All the greases to be described were passed through the homogenizer until their penetration became substantially constant. Two or three passes were usually required.

Grease yield depends on the model of the homogenizer used, as is shown in Figure 7. These greases were prepared with similar estersil concentrations in a single oil, using the 25 and 100 gph machines with a pressure drop of 5000 psi. About five per cent less thickener was required with the larger model.

Grease yields also depend markedly on the type and viscosity of the oil used, as is illustrated in Figure 8. These greases were prepared with the 30 gph homogenizer at a 5000 psi pressure drop. Yield generally increased with increasing oil viscosity but there were exceptions due to oil type.

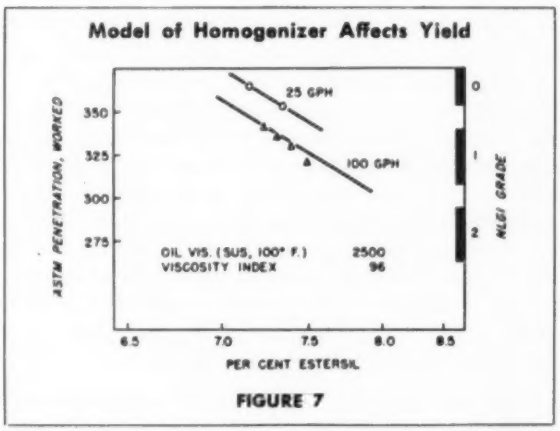

FIGURE 7

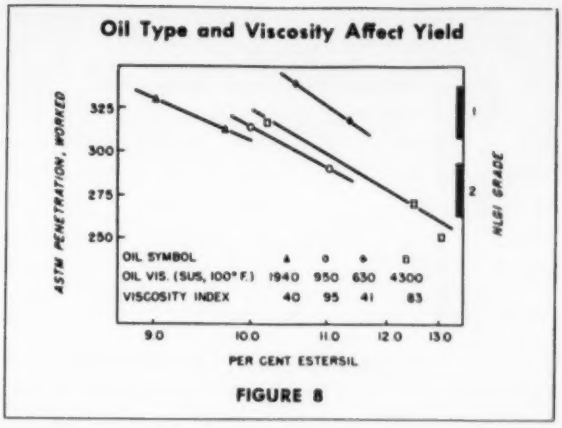

FIGURE 8

The factors which have been discussed must be considered in developing a commercial process for making estersil greases. One practical process which has been used on a pilot plant scale is outlined in Figure 9. The estersil and oil are mixed in a well agitated vessel which is equipped for heating and evacuation to aid separation of air. A preliminary breakdown of the estersil grains is achieved by use of a feed pump with a larger capacity than the shear mill, permitting the excess capacity to recycle to the pump inlet through a pressure release valve. Recycling a portion of the output to obtain the desired average number of passes through the mill permits continuous milling of a finished grease ready for packaging.

Grease Properties

Greases made from the preferred estersil were found to have properties which are attractive for multipurpose and specialty type applications. In general, these properties are those which might be expected from oils thickened with a chemically inert material, combining the mechanical properties of the thickener and the chemical properties of the oil.

Wear

Others have shown that fine silicas having ultimate particles in the size range of the preferred estersil can be

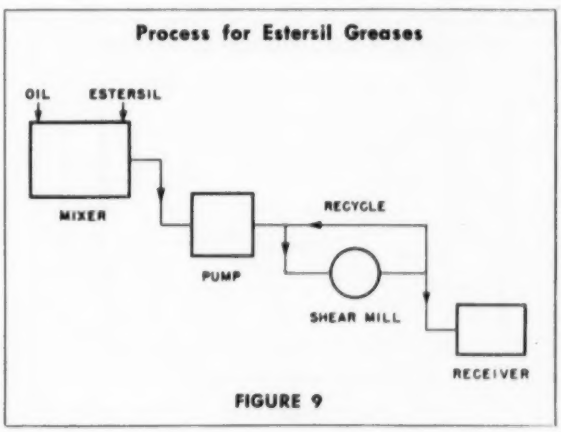

FIGURE 9

TABLE VI

Water Resistance Tests

Grease Type	*NLGI Grade*	*Water Washout at 100°F.*	*175°F.*	*Water Tolerance*	*Life in Boiling Water*
Estersil	0	4%	4%	50%	170 hours
Lithium	2	—	14%	60%	3-24 hours
Calcium	1	15%	19%	20%	0.1 hour
Barium	2	53%	61%	20%	2 hours

TABLE VII

Mechanical Stability in Presence of Water

Grease Type	*Original*	*Micropenetration Hrs. in Shell Roll Appar. with 10% Water*				
		0	1	2	4	6
Estersil	94	77	65	73	85	96
Lithium	101	90	101	121	150	181
Calcium	115	142	176	187	198	215

used as thickeners or additives in lubricants without causing abrasive wear.[4,5] In agreement with these findings, estersil greases displayed no abrasive wear in tests with such laboratory equipment as the Timken, Almen, and Cornell machines. Further, no signs of abrasive wear have been observed in any use tests.

Mechanical Stability

The mechanical stability of estersil greases can be varied by changing the severity of milling during grease preparation. Figure 10 shows the change in consistency of three samples during six hours in the Shell Roll Apparatus[6] operated at room temperature with an 11-pound roller and turning at 170 r.p.m.

These samples all contained 11.6 per cent of the preferred estersil in a solvent extracted Mid-Continent oil (viscosity 300 SUS at 100°F., VI 100). They were made with various combinations of pressure drop and number of passes through Gaulin Homogenizers. Sample I, made by a relatively mild procedure, with a total pressure drop of 5000 psi taken equally across the two pressure release valves of the 25 gph model, thickened about one NLGI grade in this test. Sample II, made with a pressure drop of 5000 psi across only one of the two valves of this machine, changed very little. Sample III, made by a relatively severe procedure, with a pressure drop of 9000 psi across the one valve of the 100 gph model, thinned more than one NLGI grade. ASTM worker tests showed the same general effects, 100,000 strokes being roughly equivalent to 6 hours in the Shell Roller. The preferred method of preparing an estersil grease and the optimum yield will depend, therefore, upon the mechanical stability characteristics desired.

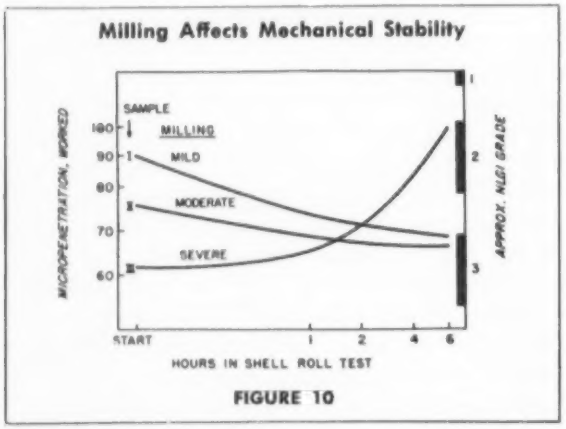

FIGURE 10

Water Resistance

The excellent resistance to disintegration by water observed in humidity box tests with greases prepared from highly esterfied estersils has already been described. Typical results from other water resistance tests on a grease made from the preferred estersil and a low viscosity oil are given in Table VI. It will be seen that the estersil grease compared favorably with other water resistant types in the water washout test described in Method 325.2.1 of Federal Specification VV-L-791d at temperatures of 100° and 175°F. and in the water tolerance test of MIL-G-16908. Unusual stability in boiling water was demonstrated by spreading a 1/16 inch layer on a microscope slide, putting the slide into a flask with water, heating the water to boiling, and determining the time required for disintegration of the grease.

The effect of water on the mechanical stability of an estersil and two water resistant soap greases is shown in Table VII. Samples were mixed thoroughly with 10 per cent water and the mechanical stability of the mixtures was determined with the Shell Roll Apparatus. The estersil grease thickened somewhat upon addition of water but returned to its original consistency upon subsequent working.

Properties at Elevated Temperatures

Estersil greases, like all inorganic greases, have no melting point and undergo no phase changes with changing temperature. Further, as indicated in Figure 11, the change in consistency of an estersil grease with temperature is less than that observed with a multipurpose type soap grease. Micropenetration cups equipped with thermocouples were filled with grease and brought to the desired temperature in an oven. The consistency of the sample was then measured quickly. Because of this relatively small change in consistency with temperature and other mechanical properties, it appears that softer grades of estersil greases should be used than would normally be recommended with soap greases.

It appears especially desirable to use a soft grade of estersil grease in ball bearings and other applications

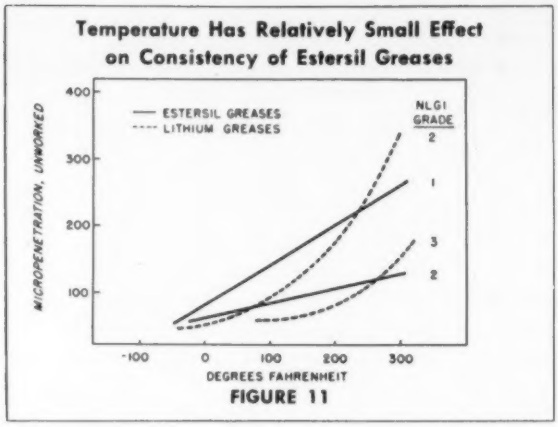

FIGURE 11

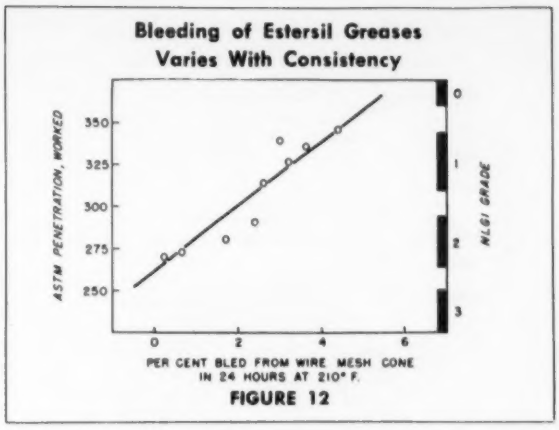

FIGURE 12

where bleeding is important for lubrication, since hard estersil greases bleed very little, as is shown in Figure 12. Wire mesh cones like those described in Federal Specification VV-L-791d, Method 32.1.1 were filled with 10-gram samples of greases made from several low viscosity oils (viscosity 200 to 600 SUS at 100°F., VI 33 to 100) and kept overnight in an oven at 210°F. The amount of oil which separated was then determined. Greases of NLGI grade one gave three to four per cent bleeding, while NLGI grade two greases bled very little.

The ability of greases prepared from estersils to resist softening upon exposure to elevated temperature, cooling, and working has already been mentioned briefly. Further data illustrating this point with greases prepared from three different oils and indicating that base oil type can affect the stability are given in Figure 13. In this case the elevated temperature properties were observed by packing two-ounce jars over-full with the test grease, storing them in an oven at 300°F. for various intervals, cooling to room temperature, milling the greases two passes through an ink mill, and then determining penetrations with the Shell cone. It will be seen that greases from two of the oils showed no significant change in consistency over the exposure period while one hardened about two grade ranges. Therefore, the effect of base oil type should be considered in formulating estersil greases for high temperature service.

Oxidation Stability

Uninhibited estersil greases have excellent oxidation stability as measured by the oxygen bomb procedure described in ASTM Method D942-50. Figure 14 compares the pressure drops displayed by two estersil greases with the pressure drops shown by the oils from which they were made. It will be seen that the estersil has substantially no pro-oxidant effect, the greases being almost as stable as the oils.

When estersil greases are tested by the copper catalyzed oxygen bomb procedure described in ASTM Method D1261-53T for determining the effect of grease on copper, they cause no staining of the copper strips, but their oxidation stability is reduced. They are, however, more stable in the presence of copper than many inhibited soap greases, showing pressure drops of only 10 to 20 pounds in 200 hours.

The addition of conventional antioxidants increases oxidation stability both in the presence and absence of catalytic metals and may be desired in greases designed for high temperature applications. The effect of an antioxidant on other grease properties is negligible.

Anti-Rust Properties

As indicated in Table VIII, the rust prevention properties of additive-free estersil greases were not as good as those of several commercial soap greases in two rust prevention tests. In one procedure, sand blasted mild steel test panels were coated with grease, the excess grease wiped off with cheese cloth, and the panels exposed in a humidity cabinet at 120°F., 100% relative humidity for six days. In the other procedure, polished steel rods were half covered with mixtures of one part water and four parts grease in small sealed jars and held at room temperature for three days. From these data it appears that the rust prevention properties of additive-free estersil greases may not be adequate in some applications.

Additives have been found which are effective anti-

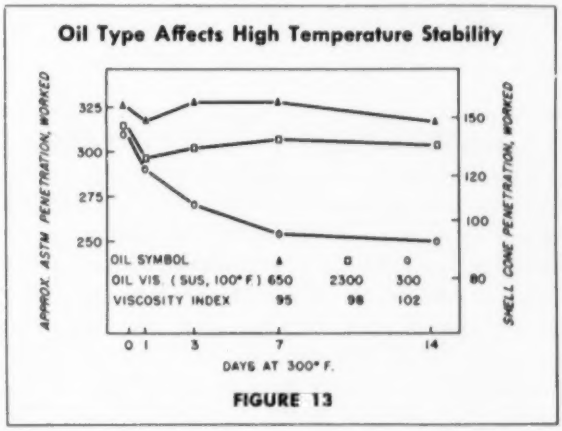

FIGURE 13

Estersil Greases are Nearly as Stable to Oxidation as the Base Oils

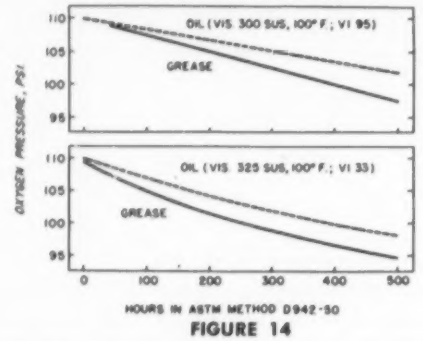

FIGURE 14

rust agents and without significant influence on grease yield or high temperature properties. The results of tests on a formulation containing such an additive are shown in the table.

Compatibility

It is quite important that any new type of lubricating grease may be compatible with the types already in use. Table IX summarizes data on the compatibility of an estersil grease with four commercial greases, as measured by a severe modification of the ASTM Method D1263-53T for determining the leakage tendencies of automotive wheel bearing greases. Mixtures were prepared with equal weights of all the possible pairs of these greases. These mixtures and the five separate, unmixed greases were evaluated in the wheel bearing apparatus, filling the hub overfull with 150 grams of grease and running the test at 250°F. and 660 r.p.m. for six hours. Under these conditions some of the soap greases were incompatible, their mixtures giving more leakage than either component. No such indication of incompatibility was observed with the estersil grease.

TABLE VIII

Additives Improve the Anti-Rust Properties of Estersil Greases

Grease Thickener Type	*Per Cent of Area Protected from Rusting Steel Panels in Humidity Box, 120°F., 100% R.H. 6 days*	*Steel Rods in Jars with Grease and Water 3 days*
Calcium Soap	100	100
Sodium Soap	0	100
Lithium Soap A	95	95
Lithium Soap B	75	90
Estersil	75	50
Estersil with Additive	100	100

TABLE IX

Estersil Greases Are Compatible in Modified ASTM Wheel Bearing Tests

(150 g, 250°F., 660 RPM, 6 hrs)

Grease Type	*ASTM Worked Penetration*	*Grams Leakage With 50-50 Mixtures Containing Estersil*	*Soda*	*Soda-Lime*	*Lithium*	*Inorganic*
Estersil	313	10.8				
Soda Wheel Bearing	253	17.0	57.5			
Soda-Lime Ball Bearing	285	14.5	83.1	16.5		
Lithium Multi-Purpose	285	10.1	88.1	2.0	20.2	
Inorganic Multi-Purpose	302	4.5	31.7	75.3	18.6	10.8

Underlined values obtained with separate, unmixed greases.

SUMMARY

1. Estersils as a class are very promising materials for use as thickening agents in lubricating greases.
2. An estersil has been developed which, on the basis of laboratory tests, allows preparation of additive-free greases having wear properties comparable to soap greases and the following advantageous characteristics:
   a. Ease of preparation
   b. Good mechanical stability
   c. Good water resistance
   d. Relatively small change of consistency with temperature
   e. Resistance to softening upon exposure to elevated temperatures and subsequent working
   f. Good oxidation stability
   g. Compatibility with soap greases

Extensive field testing of greases prepared from the preferred estersil, including some formulations containing anti-rust agents, has been underway for some time in both multipurpose and specialty type applications. Results to date have confirmed the encouraging observations made in the laboratory.

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Above left and right . . . the registration desks.
No meeting is complete without them.

The first session on Monday Morning was presided over by H. L. Hemmingway. To the right are Jesse W. Tapp and NLGI President, G. A. Olsen.

Opening speaker, Jesse W. Tapp, Vice Chairman of the Board of Directors, Bank of America.

NLGI Annual Meeting

Monday Morning

Here and on the following pages you will see a picture story of the events and people at the NLGI twenty-second Annual Meeting held at the Mark Hopkins Hotel, San Francisco, October twenty-fifth to twenty-seventh.

The entire afternoon was devoted to a Symposium —Studies of Grease Structure—a Basis for New Developments.

Sitting at a wide U shaped table that stretched across the front of the meeting room and along both sides were 24 members of the Panel.

Chairman of the session W. M. Murray (left) and L. C. Brunstrum, Panel Chairman.

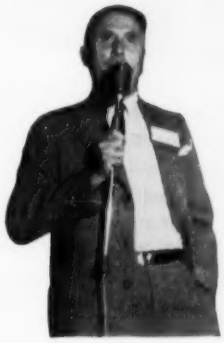
Part of the Panel who participated in the Symposium.

Strictly technical the Monday afternoon session involved so many people and subjects that perfect planning and coordination were necessary. L. C. Brunstrum did an outstanding job of both.

What Goes Into an Annual Meeting

What goes into an NLGI Annual Meeting besides people? The answer is lots of thought and hard work, much of it stretching over many years. It's these two ingredients that attract people to our meetings. People are the result—not the cause of our enthusiastically attended meetings.

If we were to recall here all the loyal NLGI members who unselfishly put their time, thought and efforts into our twenty-second Annual Meeting we would need this entire magazine plus the collective memory of every person attending. Since they are now dispersed from Japan to Canada and we only have 56 pages, the best we can do now is mention only a few.



Planned by H. L. Hemmingway, the program was perfectly balanced. He also introduced the manual "RECOMMENDED PRACTICES for LUBRICATING AUTOMOTIVE FRONT WHEEL BEARINGS" that has already received more than 50,000 orders for copies to be distributed to service men and marketing divisions by companies in our industry. Presented at the meeting for approval, we know at least three years were spent in writing the manual. With youth, thoughtfulness and an unselfish desire for progress by this industry, Mr. Hemmingway is the 1955 President of NLGI. You can see him at the top of this page.

Look at the bottom and here is L. R. Brunstrum seriously leading his panel discussion with Dr. Marjorie Vold. A contribution to industry progress is H. M. Fraser, who won the NLGI Award for Outstanding Service. His is second from the top.

Then there's T. G. Roehner, able Chairman of our Technical Committee, answering a question from the audience. He's pictured just above Vold and Brunstrum.

Look at it from another standpoint. For the most part wives accompanied husbands to the meeting. Their entertainment was paid for by:

Mr. Al Weist, Shell Oil Company
Mr. James Ransford, Tide Water Associated Oil Co.
Mr. Frank Ott, Union Oil Company of California
Mr. L. J. Grunder, Richfield Oil Corp.
Mr. Mac Saunders, The Texas Company
Mr. C. R. Christian, The General Petroleum Corp.
Mr. R. W. Goodale, Standard Oil Company of California

NLGI Director, R. W. Goodale planned and supervised both a style show and trip to Muir Woods. Also deserving appreciation is the Archer-Daniels-Midland Company who entertained the wives with a luncheon. Then there is Carl Watson who helped so efficiently with the multitude of details incidental to the operation of a meeting.

One very important contribution was the complete photographic coverage provided by the Standard Oil Company of California Engineering Department. Generously they gave us the pictures you see on these pages.

These are only a few of the people and companies that made our meeting such a success. You will see many more names and pictures on the opposite and following pages.

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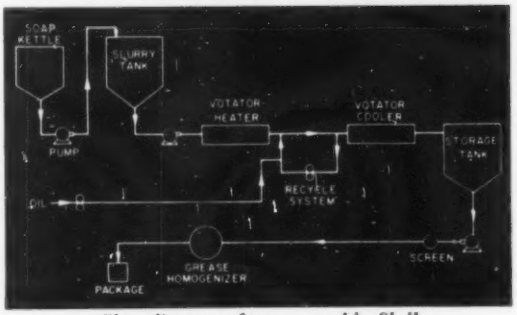

Flow diagram of process used by Shell

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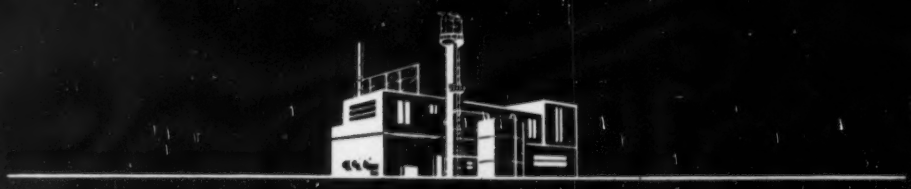


Tuesday Morning . . .

A Panel Discussion—FIELD EVALUATION OF LUBRICATING GREASES IN FLEETS AND CARS

Here is the Panel: (left to right) Panel Chairman, L. J. Grunder, James H. Booth, H. R. Wolf, Frank R. Hart, H. C. Zweifel and Claude L. Johnson.

James H. Booth . . . "what problems there are in lubricating the ball joint . . ."

H. R. Wolf . . . expressed desire for lubricant that is thermally and mechanically stable.

Frank R. Hart . . . "The bearing is the deciding factor."

H. C. Zweifel . . . "Well, what constitutes good lubrication?"

Claude L. Johnson . . . "as a producer . . . we are confronted with many problems."

Tuesday noon and a style show for the wives. On the left is R. W. Goodale handling the event.

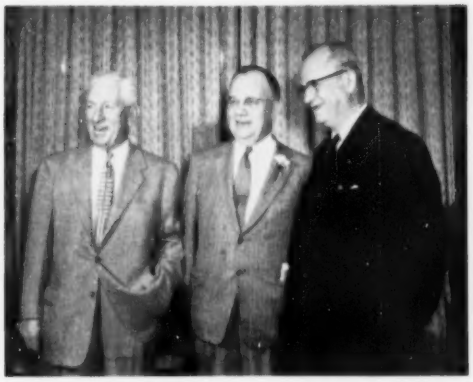
Tuesday Noon

STYLE SHOW

While the men were seriously discussing lubrication problems, holding a Board of Directors Meeting and electing officers for 1955, their wives were engaged as you see them on the left. A style show at the San Francisco Yacht club paid for by NLGI West Coast members previously mentioned.

Also on Tuesday Noon . . . NEW OFFICERS WERE ELECTED

NLGI Officers for 1955 (left to right) A. J. Daniel, Treasurer, W. M. Murray, Vice President, H. L. Hemmingway, President and Harry F. Bennetts, Executive Secretary.



Just before the Board of Directors meeting are: B. G. Symon (left) G. A. Olsen (center) and W. H. Saunders (right). Both Symon and Saunders are past presidents, Olsen in 1954. Mr. Saunders is one of three men who originated NLGI in 1933.

Tuesday Afternoon . . . NEW APPROACHES . . . ESTERSILS AND . . . THE NEW LOOK

C. F. Carter describing the design of apparatus for the measurement of apparent viscosities of greases.

G. C. Meyer . . . "Estersil greases are made by an entirely mechanical process. . ."

W. H. Peterson discusses Estersil paper.

FOUR DESCRIPTIONS OF THE NEWEST LUBRICATING GREASE MANUFACTURING FACILITIES IN NORTH AMERICA

O. L. Yarham (Cities Service) describes trends and basic considerations in design and selection of grease plant equipment.

R. O. Rinearson . . . describes planning, design and installation of new British American grease plant.

E. L. Sutton describes Pure Oil's facilities at Smith's Bluff, Texas.

E. W. Nelson . . . describes changes in Continental's plant that has kept it modern.

Tuesday Evening . . . SOCIAL HOUR AT "TOP OF THE MARK"

Here is the crowd streaming into Top of the Mark.

Here two Chinese girls pin on flowers furnished by Chek-Chart.

Oblivious to commotion (left to right) are R. W. Goodale, Mrs. Goodale, Mrs. Olsen and G. A. Olsen.

Drs. Marjorie and Robert D. Vold.

Extreme left and right are Cato's Leon Oswalt and Walter Ewbank. Center, A. L. McClellan (California Research Corp.)

Talking it over, R. W. Goodale and H. R. Wolf.

Introduced by outgoing President G. A. Olsen and taking a bow are 1955 President H. L. Hemmingway and Mrs. Hemmingway. Applauding is W. M. Murray 1955 Vice President.

Then . . .

BANQUET IN PEACOCK COURT

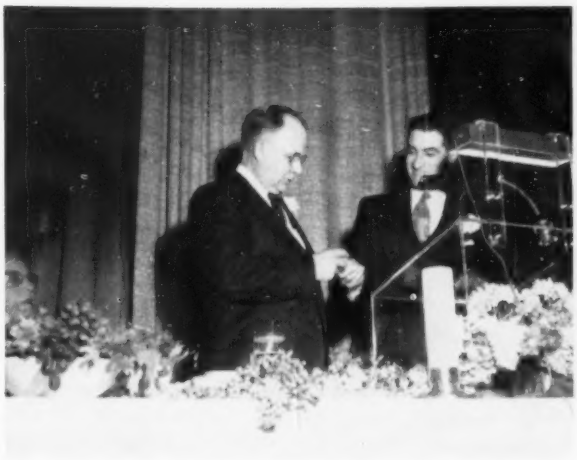
Resuming his seat at head table President Hemmingway looks things over.

H. M. Fraser receives the NLGI Award for Outstanding Achievement from G. A. Olsen. Mrs. Fraser stands proudly beside her husband.

H. M. Fraser acknowledges applause from banquet crowd. Giving full credit for award to people who worked with him.

Back to his place at head table he receives congratulations from Mrs. Fraser and Mrs. G. A. Olsen.

CHEERS AND TRIBUTE TO A GREAT PRESIDENT

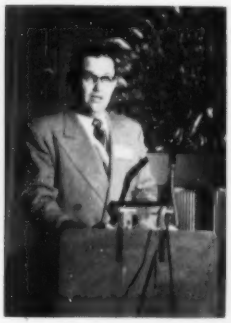


Another high mark during banquet—presentation of President's key to outgoing President G. A. Olsen by 1953 President W. W. Albright.

Following the ceremony, H. L. Hemmingway praised the outstanding leadership shown by Mr. Olsen during the past year. Entire banquet crowd stood and applauded.

Wednesday Morning . . . TECHNICAL COMMITTEE SESSION

Presiding at Session is able T. G. Roehner (left) and E. S. Carmichael. Roehner is also Chairman of Technical Committee.



H. C. Zweifel tells about classification of greases.

C. J. Boner reports on procurement of papers for *Spokesman*.

B. B. Farrington describes review of all technical papers considered for *Spokesman*.

For many years the NLGI Technical Committee has met on Wednesday morning. Session has always been led by T. G. Roehner, Committee Chairman, with E. S. Carmichael taking the minutes. This year time was completely devoted to reports of Chairmen of Sub-Committees of the Technical Committee.

W. J. Ewbank reviews accomplishments toward producing a manual of terms and test methods peculiar to this industry.

H. L. Hemmingway describes new Manual on lubrication of front wheel automotive bearings.

N. Marusov discusses proposed method for matching grease flow properties with dispensing equipment at low temperatures.

Late Wednesday afternoon all packed and ready to leave, R. W. Goodale says goodby to NLGI Executive Secretary and Mrs. Bennetts. End of the meeting.

Patents and Developments

Cellulose Base Lubricating Grease

Various materials much unlike conventional soaps, such as wood pulp and other cellulose substances, may be divided into micro-particles sufficiently fine that a good grease structure may be established when they are placed in oil. Such materials are mentioned in U. S. Patent 2,583,603.

According to U. S. Patent 2,682,506 assigned to the National Research Council of Canada, moisture-stable lubricating greases are claimed to be produced from cellulose and cellulose type materials by the addition of certain resins and/or metal soaps to the cellulose materials to render them relatively water-repellent. When the normal water content of cellulose is replaced by acetone, for example, and the acetone is ultimately replaced by mixing with a lubricating oil such as mineral base oil, and the acetone is flashed off, the cellulose retains its original colloidal or gel-like structure unless and until it comes in contact with moisture, when it becomes useless as a lubricant. By treating the cellulose, while in presence of oil, with surface-active agents which are hydrophobic in nature, the greases are very substantially improved. A particularly suitable agent is the resinous reaction product of equimolar proportions of maleic anhydride and glyceryl monoricin-oleate.

It is also desirable to treat the cellulose itself to give it the desired physical properties for lubricating grease purposes. Cellulose of the appropriate type may be obtained readily by treating viscose with dilute mineral acids such as sulfuric acid or phosphoric acid. By carrying the acid precipitation in presence of sodium sulfate, cellulose is produced of sufficiently fine fibrous structure that it sets up a stable grease structure with lubricating oils. Without the sodium sulfate, it is somewhat coarser and less satisfactory.

In lieu of the resin specified, other oleophilic materials may be employed, such as Al, Ca, Ba or Li stearates which are used in proportions of 3-60% of the weight of solvent-exchanged cellulose, or about one-tenth of these proportions when based on the total grease. For example, a composition containing about 4-10% by weight of cellulose, based on the solvent-free material, about 4-8% of maleic anhydride-glyceryl monoricinoleate resin, 0-6% of soap, and the remainder of lubricating oil, is claimed to make a good grease composition.

When soap-treated cellulose is to be used, the soap preferably is formed on the cellulose as the latter is precipitated. In either case, upon precipitation a slurry of viscose is formed which may be treated next with a mild alkaline solution to condition it for further processing. Thereafter the slurry is filtered and the precipitated cellulose is washed substantially free from water soluble materials. It is next solvent exchanged with a soluble mutual solvent for oil and water, such as acetone. Other mutual solvents, such as an appropriate alcohol or ether, especially propyl and butyl alcohols, and pyridine, may be used in lieu of acetone, some of these being pointed out in Patent No. 2,583,603 previously mentioned. The solvent selected should vaporize at a temperature well below that of the mineral base oil or other lubricating oil used. The mutual solvent may, in turn, be replaced directly by lubricating oil or it may first be replaced by an intermediate solvent such as petroleum ether or the like and the latter replaced by the lubricating oil. In this way, the water of the cellulose-water system may be removed without shrinkage of the cellulose. The cellulose-solvent system thus obtained may be termed a solvent-exchanged cellulose. Greases made directly from this type of cellulose, i.e. by solvent exchange, result when oil is added to the solvent-exchanged cellulose and the solvent is flashed off. They immediately begin to disintegrate, however, in the presence of water.

The cellulose component absorbs or adsorbs water in preference to oil and the product is useless, especially where the grease is to come in contact with free water or with quantities of moisture in any form.

The greases of this patent may be substantially improved in water resistance by adding modified resinous condensation products of polyhydric alcohol and polybasic acid. These may be waterproofing agents of the maleate-glyceryl ester type, previously mentioned. The manner in which this is done is an important aspect of this invention. While, as previously mentioned, the preferred waterproofing agent is the reaction product of maleic anhydride and glyceryl monoricinoleate in substantially equi-molar proportions, related alkyd resins such as those obtained by reacting tetrachlorophthalic anhydride with glycerylmonostearate or by reacting succinic acid with glyceryl monostearate may be used, though somewhat less satisfactory. Related monoesters of glycerol, such as the mono-oleate or monoricinoleate may be used.

A typical preparation is as follows:

500 grams of viscose were added to 1500 cc. of water containing 20 grams of sodium sulfate and 8.2 grams of sodium stearate. In order to keep the viscosity low the mixture was heated moderately to a temperature of 50 to 60° C. The cellulose and an aluminum stearate were coprecipitated from the solution by adding 500 cc. of an aqueous solution containing the calculated amount of concentrated sulfuric acid and aluminum sulfate. The aluminum sulfate obviously reacts by double decomposition with the sodium stearate to precipitate the aluminum soap. However, since the viscose is normally sufficiently alkaline, stearic acid may be used if desired in lieu of sodium stearate, e.g. as an emulsion in the first water solution mentioned above.

After precipitation, the slurry of cellulose and soap in water was treated with 5 to 10 cc. of 3 normal ammonium hydroxide. This raised the pH value of the slurry to

about 8. The slurry was then filtered, washed free from soluble salts and solvent exchanged with acetone. Oil was added and the acetone flashed off by heating above its boiling point.

Greases made in the manner just described were found to be somewhat water repellent without the addition of resin. However, they disintegrated after shearing in the presence of water at 70° C., and a few strokes in the grease worker described above.

Lithium Polyorgano Siloxane Polymer Greases

A lithium soap-silicone polymer grease which is stable at high temperatures with respect to consistency and which is resistant to leakage at high temperatures is described in U. S. Patent 2,684,944 issued to Standard Oil Company (Indiana). Production of such a grease without use of volatile solvents is outlined.

A composition giving the properties outlined, as well as having a high dropping point, is one containing a major proportion of silicone polymer oil, 2-10% of a lithium soap of a high molecular weight fatty acid, and a free basic compound in amount of 50-300%, based on the lithium soap content of the grease.

The basic compound to provide excess alkalinity may be basic alkali metal compounds, basic alkaline earth compounds, high boiling basic organic nitrogen compounds, such as aliphatic or aromatic amines boiling above 250° F., etc. Examples of such compounds are sodium hydroxide, lithium hydroxide, barium oxide, calcium hydroxide, triphenylamine, octylamine, etc.

Greases of the present patent are claimed to be easily prepared and do not require the use of solvents which must be subsequently removed as is made necessary by previous methods of preparing such greases. In preparing greases of the present patent, all of the lithium soap, a portion of the polyorgano siloxane and all of the basic compound, preferably in the form of an aqueous solution or suspension, of about 5% to about 35%, are mixed together, slowly heated to a temperature of about 212° F., and maintained at this temperature until the mixture is substantially free of water. When the mixture is substantially anhydrous, and foaming, if any, subsides, the remaining portion of the polyorgano siloxane is added, the batch heated to a temperature of from about 450° F. to about 550° F., and preferably to a temperature of about 500° F. to 510° F., and maintained at said temperature until the reaction is completed. The grease is then filled and cooled. The cooled product, if desired, can be homogenized by well known means.

A preferred grease stable at temperatures of at least about 450° F. is illustrated by the following composition:

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Alkali metal or alkaline earth hydroxide	2-10%
Polyorgano silicone	80-97%

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PEOPLE in the Industry

Alexander Kidd to Stewart-Warner

Alexander Kidd, formerly vice president of The M. W. Kellogg Company, New York, has been elected a vice president of Stewart-Warner Corporation, Chicago.

In his thirty-four years with The M. W. Kellogg Company, a subsidiary of Pullman, Inc., Mr. Kidd rose from draftsman through such operating and administrative positions as chief engineer for manufacturing, vice president in charge of manufacturing, and sales vice president. He has served on the boards of both the Kellogg Company and of Pullman-Standard Car Manufacturing Company.

Mr. Kidd is a member of several engineering societies, including the American Society of Mechanical Engineers, the American Petroleum Institute and the American Society for Testing Materials. He holds a professional engineer's license in the state of New Jersey.

Dr. R. H. Patch Dies in Arkansas

The death of Dr. Richard H. Patch, Vice-President—Operations, is announced by E. F. Houghton & Co.

Dr. Patch, who was 66, died in Hot Springs, Ark. on November 13th. He had been with Houghton since 1926. He held an A.B. and doctorate from Harvard University. From 1914 to 1926 he was a plant official at the Midvale Co., Philadelphia.

Noted as a big-game hunter, Dr. Patch had trophies from Alberta, Alaska and Rhodesia. He was a Fellow of the Royal Geographical Society and member of the Explorers' Club, the Union League, Sons of American Revolution and Executive Council of the Harvard Foundation.

He was a former president of the Philadelphia Chapter, American Society for Metals. He was a member of Houghton's Board of Directors, Executive Vice-President of E. F. Houghton & Co. of Canada, Limited, and Treasurer of the Houghton Vix-Syn Co., Hopkins, Minn.

One-third of the 70 million drivers of cars, trucks, and busses in the U. S. are women.

Shell Names Three To New Refinery And Research Posts

Shell Oil Company has appointed new managers at refineries at Houston, Texas, and Martinez, California, and Shell Development Company has named a new manager at the Emeryville, California, research center.

John A. Tench is the new manager of the Houston refinery, succeeding Paul E. Hurley, who died recently. Tench, who has been manager of the Martinez refinery, is being succeeded there by Bruno Stolley, formerly manager of the Emeryville laboratory. Replacing Stolley is John R. Morrison, who has been assistant manager of Shell Oil's industrial relations department.

Tench, who has been with Shell for 26 years, has spent most of his career in the company's West Coast refineries. From 1939 to 1946 he was in charge of operations in the San Francisco office manufacturing department. He became superintendent at Martinez in 1946 and was promoted to manager in 1949.

Stolley, who started with Shell in 1929 in the engineering department at the Norco, Louisiana, refinery, became assistant chief engineer at Houston in 1934. In 1946 he was appointed assistant manager of head office personnel department in New York. He was named manager at Emeryville in 1949.

Morrison joined Shell at the Houston refinery in 1938. After holding positions in chemistry and technology, he was named assistant industrial relations manager at the refinery in 1946. He was transferred to the head office in New York in 1948 and became manager of the policy and training division of the personnel department in 1951. He advanced to assistant manager of the industrial relations department early this year.

About 60 different oil companies, large and small, turn out 14.5 million tons of asphalt every year in this country.

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Minnig Retained By Witco as Consultant

Carl J. Minnig, for many years a vice-president of Witco Chemical Co., having reached the company's retirement age, retired as of Oct. 1, but is being retained as a consultant and will continue to be available to his many customers and friends in the rubber industry. His headquarters will be at Witco's Akron office.

Mr. Minnig has been long and favorably known in the carbon black field because of his friendly nature and genial personality. Since 1937 he has been serving Witco-Continental interests throughout the United States. Prior to that time he was active in the development of new sources of gas supply to be used in the manufacture of carbon black and was instrumental in developing new gas fields and promoting the use of gas in industry.

Industry Loses Miller

Ray E. Miller, adviser to the Petroleum Chemicals Division of the Du Pont Company, died November 17 in Doctor's Hospital, New York City.

After more than a quarter century of association with the oil industry, he joined Du Pont September 1, 1946, as sales director for petroleum additives, and later became sales director for the Petroleum Chemicals Division. He resigned active direction of sales for the division last year for reasons of health and continued in an advisory capacity.

Mr. Miller was a member of the board of directors of the American Petroleum Institute. Before coming with Du Pont, he was a vice-president and director of the Warren Petroleum Corporation. In 1934, he joined Hanlon-Buchanan, Inc., a Tulsa oil company, as a vice-president. In 1920, he became safety engineer and personnel manager for the Marland Oil Company, now Continental Oil Company. Eight years later he was named executive secretary of the Natural Gasoline Association of America and in 1943-44. was president of that organization.

Mr. Miller was born January 18, 1895, in Burlington, Iowa, the son of Edward C. S. and Carrie B. Miller. He attended the University of Missouri.

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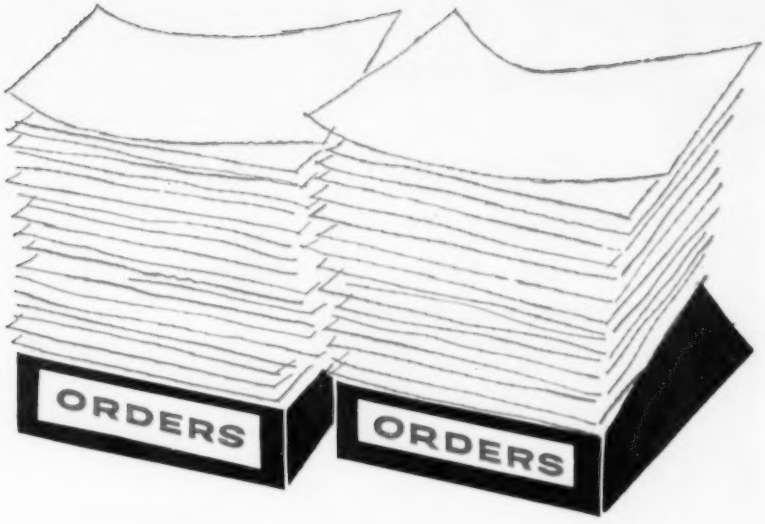

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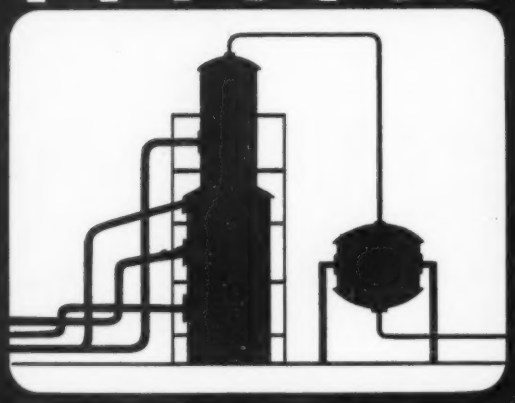

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D-A Lubricant Company President Dies

Frank L. Binford, President of the D-A Lubricant Company, Indianapolis, Indiana, passed away suddenly on November sixteenth. Prominent in both the lumber and petroleum industry, he will be sadly missed by his many friends in NLGI where he had been a long time member. Succeeding him as President is Thomas W. Binford.

Born at Greenfield, Indiana, Mr. Binford attended grade and high school in Greenfield and was graduated with honors from Central Business College there in 1906. In 1916 he purchased an interest in an Indianapolis lumber business, becoming President of the company in 1931.

In 1920 Mr. Binford organized the D-A Lubricant Company, Inc., for the manufacture of special semifluid lubricants for tractors and trucks, and became its President.

A recognized authority on taxation, Mr. Binford for many years was a member of the taxation committee of the National Association of Manufacturers.

In 1941 Mr. Binford formulated plans for the income tax "pre-payment plan" to enable the Federal government to obtain much-needed income. For his part in the project he was honored at a ceremony in Chicago in which he followed President Franklin D. Roosevelt in making prepayment on their personal income taxes.

Al Townsend to West Coast

Southwest Grease & Oil Co., Inc., of Wichita, Kansas, announces the appointment of a new West Coast Representative, Mr. A. L. (Al) Townsend.

While Al originally hailed from Kansas and later, Texas, he spent many years on the West Coast and is delighted to return in his new capacity. His many friends have been generous in expressing their confidence that his past experience will be of tremendous value in enabling him to do an outstanding job with Southwest products for this area. He is a specialist in service supervision and in public relations, and has received intensive training in petroleum products.

A. L. (Al) Townsend

New policies with regard to deliveries and warehousing are being instituted by the Southwest Grease & Oil Co., Inc., coincident with Mr. Townsend's appointment.

Hawkins Assumes New Position

Appointment of Phillips Hawkins as assistant to vice president—raw materials, United States Steel Corporation, has been announced.

Mr. Hawkins, who has been a general attorney for the corporation, received a B.S. degree from Trinity College in 1939 and a L.L.B. degree from Yale in 1941.

In 1942 Mr. Hawkins was employed by Hercules Powder Company as a patent attorney and served in this capacity until 1944 when he joined the Rubber Reserve Corporation as chief patent counsel. He left this position in 1946 to become an economic advisor to General Clay in the military government of Germany where he had broad administrative duties.

Upon the establishment of the German government in 1949, he returned to this country and joined the law department of U. S. Steel as an attorney in early 1950.

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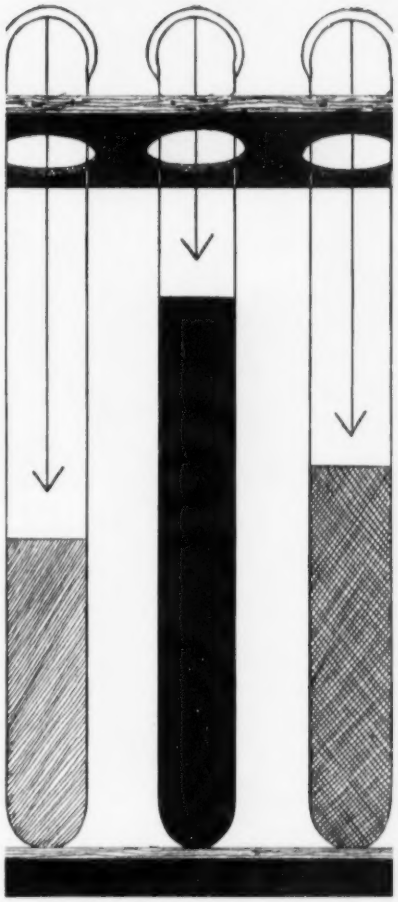

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Mallinckrodt Sales Dept. Announces Promotions

Three promotions in the sales department have been announced by Joseph Fistere, President of Mallinckrodt Chemical Works, St. Louis. Mr. G. C. Bradshaw was made director of sales research, Mr. Walter S. Keutzer named western division sales manager and Mr. Warren F. Michener appointed assistant western division sales manager.

Before being named director of sales research, Bradshaw was western division sales manager for Mallinckrodt for seven years. He joined Mallinckrodt in 1925 and in 1936 he was made assistant western division sales manager.

In addition to his direct sales responsibilities, Bradshaw instigated many general merchandising programs at Mallinckrodt. He wrote the first edition of the widely distributed "Chemistry of Photography." In 1935 he organized the Mallinckrodt Plan Board. This board of leading men in the drug field outlined seven basic merchandising elements important to the operation of a successful prescription drug store. In addition to publishing these merchandising ideas Bradshaw toured the country discussing them with groups of drug store owners. For approximately 20 years he directed advertising. Bradshaw represented Mallinckrodt in many trade associations, among them the ADMA, APMA and AWDA.

Walter S. Keutzer, newly appointed western division sales manager, joined Mallinckrodt in 1910. In 1949 he was made assistant sales manager. Before this he was in charge of the sale of medicinal and hospital chemicals. During thirty two years in the sales department at Mallinckrodt he spent approximately eighteen years as a sales representative in the middle west. Keutzer also has represented Mallinckrodt in many trade association activities.

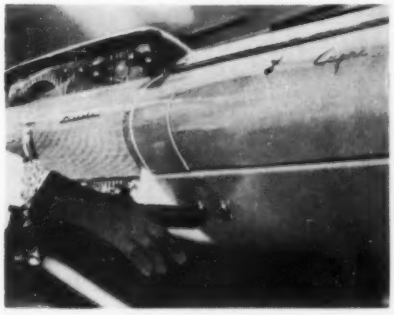
Prior to his appointment as assistant sales manager, Warren F. Michener was manager of the laboratory chemical sales division, western territory, and more recently temporarily in charge of the Chicago regional office.

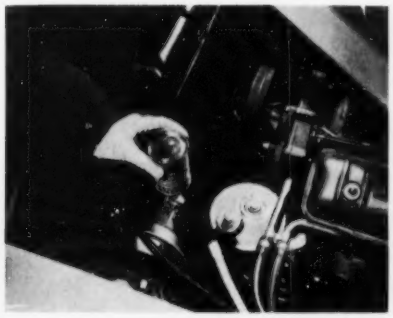
★

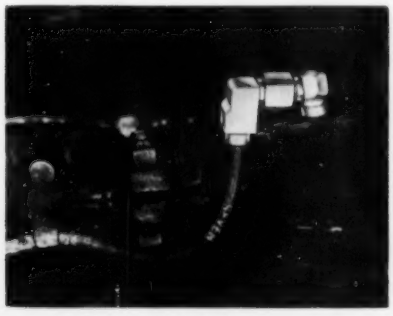
Leading the list of privately-owned railroad tank cars are those employed in transporting petroleum.

Industry NEWS

LINCOLN ENGINEERING ANNOUNCES THE NEW MULTI-LUBER







Shown at left is the control button that requires only a finger-tip touch. A fresh can of lubricant is being inserted in the middle picture. At right is a close-up of the special coupling at terminal of each lubricant feed line.

A vacuum-operated, high pressure lubrication system which lubricates the chassis bearings on passenger cars by the mere press of a button is now available on 1955 model Lincoln automobiles as an optional factory installed accessory, and on 1955 model Mercurys as an optional dealer installed accessory.

This newest addition to power accessories for passenger cars is known as the Multi-Luber, and is designed and manufactured by the Lincoln Engineering Company of St. Louis.

The power lubrication system consists of a control button on the instrument panel and an injector pump located in the engine compartment from which tubular feed lines of tough, fabric insulated nylon extend to the lubrication points on the chassis, suspension and steering systems. Feed lines terminate in a specially designed coupling which locks securely over the regular grease fittings, providing a positive, leakproof connection. A finger-tip touch of the control button admits vacuum, drawn from the intake manifold, to the injector pump. Motion of the vacuum diaphragm forces piston into lubricant measuring chamber dispensing an equal, premeasured amount of lubricant through the feed lines to each bearing point. The entire operation requires only a few seconds, and a green indicator light on the instrument panel flashes when lubrication cycle is completed.

By pressing the power lubrication button every 50 miles, or once a day, the car is always thoroughly and properly lubricated with refinery pure grease. The Multi-Luber can be operated 200 times, or for an estimated 10,000 miles, before it is necessary to replace the seven ounce disposable can of lubricant supplying the system.

This vacuum-operated lubrication system is the newest addition to other Lincoln Multi-Luber systems, previously announced, which are available in automatic air-operated, and manually operated models for applications extending through the range of trucks, trailers and buses; farm implements; and industrial machinery.

For complete details, write Lincoln Engineering Company, Industrial Division, 5701 Natural Bridge Avenue, St. Louis 20, Mo.

Witcombings Publishes Salute to Oklahoma

Oklahoma is hailed as a state of many potentialities for the enterprising in the fall issue of "Witcombings," official house organ of the Witco Chemical Co., which recently opened an additional plant for the manufacture of oil type furnace carbon black at Ponca City, Oklahoma.

The publication cites Oklahoma's large variety of natural resources and discusses Oklahoma's culture contributions to the nation as a whole, from opera to the famous paintings of Catlin and Remington, which were produced there.

Constantly increasing contributions of petroleum to modern life are discussed in a second article, "Petroleum —The Magic Mineral." It is estimated that daily consumption of this resource for all uses reaches 13½ million barrels daily. It is doubtful, however, if many persons outside the chemical or oil industries have a real grasp of its manifold applications. Discussion of these uses is the subject of this article.

Present uses of atomic energy by chemical and mechanical engineers, and the desirability of directly converting it into other forms of energy are the subjects of a third article in this issue. Atomic energy's role in the new science of Radiography, new weapon in preventive maintenance of expensive machinery, and future fields of development are described. The publication adds that more than 1,000 companies are already using isotopes and fissionable material as catalytic agents and chemical catalysts.

Gulf Credit Cards Now Honored by Skelly

Gulf Oil Corporation has entered into an agreement with the Skelly Oil Company which permits Skelly dealers to honor Gulf credit cards in the Skelly marketing territory, and Gulf dealers to honor Skelly credit cards in the Gulf marketing territory.

The agreement becomes effective immediately.

This arrangement makes it possible for Gulf customers to use their credit cards in all forty-eight states, and in Canada.

Gulf has similar existing agreements with the British-American Oil Company of Canada, and with the Union Oil Company which operates principally in the Rocky Mountain states and on the West Coast.

API Announces New Committee

The appointment of a new Operations and Engineering Committee within the Division of Marketing has been announced by the American Petroleum Institute.

Expected to be one of the most active of the Marketing Division's committees, the new group will absorb the functions of the division's present committee on Weights and Measures, which will be dissolved.

Scope of the new committee will be to promote such practices and procedures as are lawful and beneficial to all types of petroleum marketers and to the public in such fields as distribution, storage, warehousing, delivery, and maintenance. Special emphasis will be placed on safety, efficiency, and public convenience.

Another task of the new committee will be to work closely with associations of manufacturers furnishing the materials commonly used in building service stations, bulk plants, and terminal buildings. Basic units and dimensions for such material are expected to be developed by the new committee.

Development of factual data for all other API committees also will be a task of the new committee. Guiding its work will be an insistence upon guarding against "infringement upon or restrictions against the rights of individual industry members, contractors or suppliers to exercise initiative, research, or improvement."

To head the work of the Operations and Engineering Group, M. M. Beckes, Socony-Vacuum Oil Co., New York, has been appointed chairman. Serving with him as vice-chairman and secretary, respectively, are P. W. Engels, Shell Oil Co., New York, and Robert Niles, Standard Oil Co. (Indiana), Chicago.

Synthetic Products Announces New Booklet

A technical booklet on metallic stearates, the latest source of information about the uses and benefits of stearates and associated chemicals, has just been published by Synthetic Products Company of Cleveland, Ohio.

The new Synpro stearate booklet on metallic soaps contains not only the most advanced data available on the physical and chemical properties of types of metallic stearates, but also features the field and research experience that has been accumulated for more than 37 years by the company.

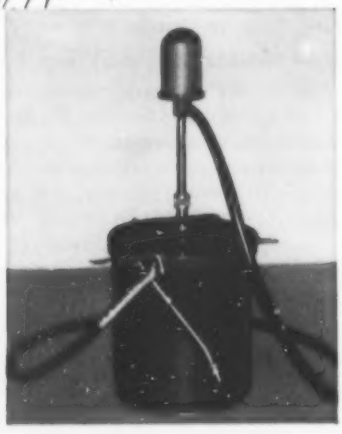
Synthetic Products has been a pioneer in the commercial production of stearates since 1922. Since that time the company has increased the list of products of stearates, vinyl heat stabilizers and specialties.

The 26-page two-color booklet is fully illustrated and features the history of the company, new plant layout, types of stearates, and detailed metallic soap specialties and manufactured products. Among the stearates manufactured are aluminum, barium, cadmium, calcium, lead, lithium, magnesium and zinc.

The Synpro plant, built in 1952, enables the company to produce more than 20,000 pounds of any metallic soap at one time. As a result,

NOW THE *Super* HEAVY DUTY GRE-ZER-ATOR*

*An all-weather grease gun designed especially for lithium and other multi-purpose greases.



- New Hydrajet Pump gives greater pump pressure and capacity. Requires neither air, electrical connections . . nor regular filling of air in pump unit.
- Reversabout Pressure Booster allows push or pull handle operation—can develop more than three tons of pressure.
- Complete one-unit operation — always ready for instant use.
- No special filling equipment required—offers convenient and continuous lubricating service.
- All-steel construction and rust-resistant finish makes the new Heavy-Duty GRE-ZER-ATOR a rugged and dependable unit.

Write for complete information on all Zee Line equipment. New regular model Gre-Zer-Ator is available now. Let us serve you.

NATIONAL SALES, INC.
812 NORTH MAIN • WICHITA 5, KANSAS

FISKE BROTHERS REFINING CO.

Established 1870

★

NEWARK, N. J.

TOLEDO, OHIO

★

Manufacturers of

LUBRICATING GREASES

regardless of quantity ordered, the metallic soap will be of absolute uniform quality in production.

George J. Chertoff, founder and president, announced that Synpro is preparing a second booklet on vinyl heat and light stabilizers, featuring barium, cadmium, tin alkyl and aryl phosphites. Synpro began producing the first vinyl plastic stabilizers in 1945. The recent plant, which is more than triple the original space, manufactures stearates and vinyl heat and light stabilizers exclusively with other allied products.

Synpro owns patents which involve the use of certain types of tin for vinyl plastic compounds and stabilizers. Two years ago, Synthetic Products embarked on an expanded sales program and increased production schedules. Garry B. Curtiss is general manager in charge of sales.

The Synpro booklet is available at no cost by writing to Synthetic Products Company, 1636 Wayside Road, Cleveland 12, Ohio.

Werly Delivers Address

The service station dealer and his employees are the most important single factor in retail success in this field.

That was the word from Glenn L. Werly, manager of the retail merchandising department of Socony-Vacuum Oil Company, Inc., to the Virginia Oil Jobbers Association meeting recently.

The service station represents a grown-up retail business today, Mr. Werly said, and retail petroleum dealers must work as hard to hold old customers and attract new ones as any other businessmen.

Socony-Vacuum, he said, has worked out by research a list of the personal qualities that characterize successful dealers as against unsuccessful ones. Finding good dealers, according to the speaker, requires searching for them as aggressively as searching for new business and, "in a practical sense, selecting a successful dealer is equivalent to signing up a new account. It takes time and it is worth it."

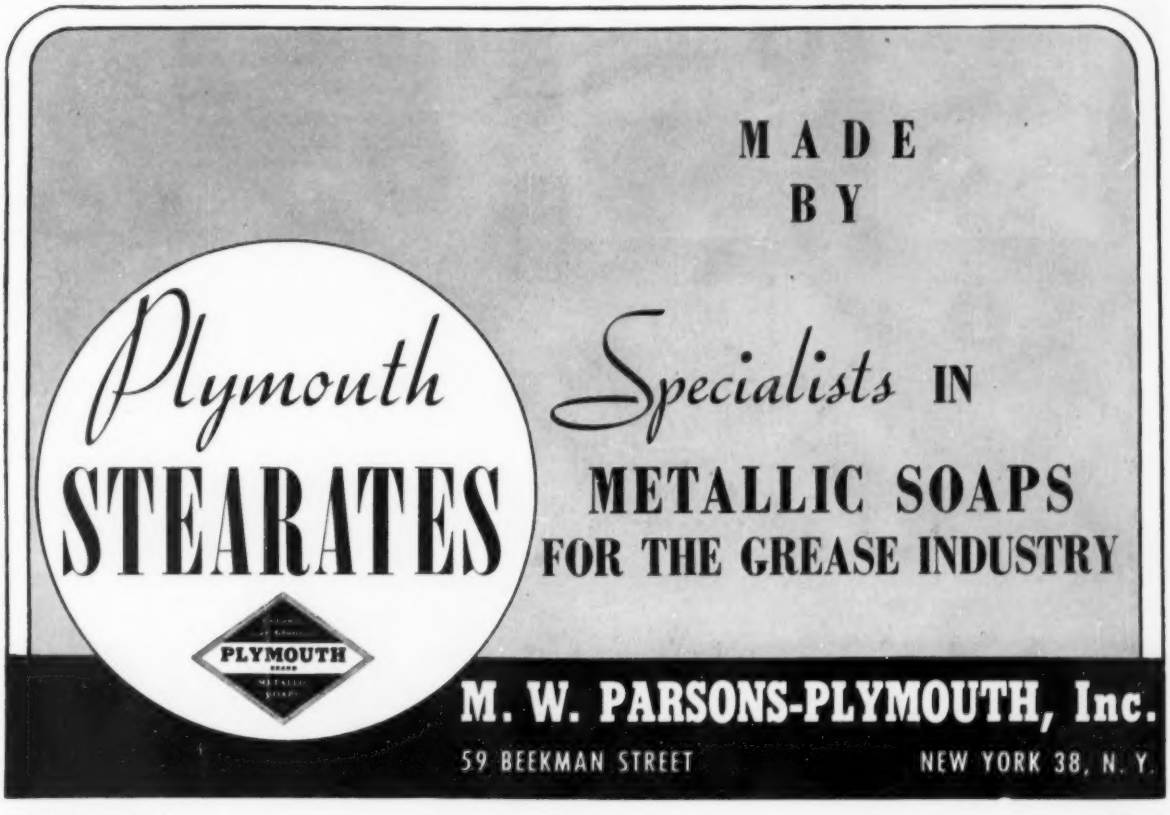
Mr. Werly said Socony-Vacuum, in seeking such dealers, looks for "a man of reasonable maturity, in good health, who has a keen ambition to go into business for himself and an unqualified desire to improve his status. We are interested in his community activities as an indication of leadership and ability to get along with people. We are interested in his hobbies as indicating a competitive spirit so essential for retail success."

Of much less importance, he asserted, are such factors as mechanical experience and financial resources.

Swan-Finch Forms New Marketing Tie

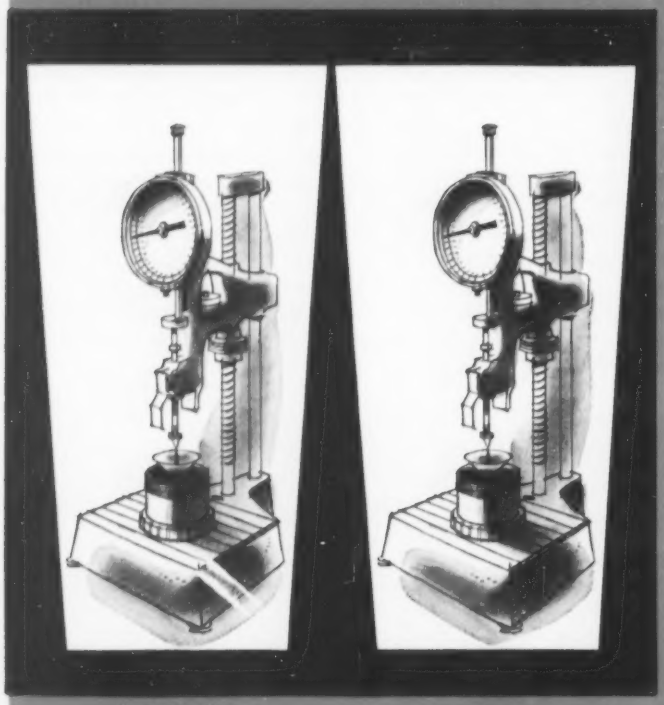
Swan-Finch Oil Corporation has embarked on a new merchandising program for its lubricating oils and greases Chairman Robert F. Six has announced.

The oil company has entered into an agreement with Orgill Brothers and Company of Memphis, Tennessee, to market Motul products throughout the South. The Orgill firm is one of the country's largest wholesale hardware and mail order establishments, and is the largest in its field in the South.



PERMAGEL

for greases that maintain consistency over a wide range of temperatures



77°F
test temperature
285
ASTM
worked penetration

200°F
test temperature
287
ASTM
worked penetration

Resistance to changes in consistency under varying temperature conditions is one of the outstanding characteristics of greases bodied with Permagel.

In the simple Penetrometer test, the ASTM worked consistency of two samples of a Permagel-bodied grease was measured. One sample was worked 60 strokes at 77°F, while the other sample was worked at 200°F. Penetrations were determined immediately. Even though there was a wide difference in temperature between the two samples, penetration values were almost identical.

This dramatizes a claim we've long made for Permagel . . . that greases bodied with this pure inorganic thickening agent are thermally stable and will maintain their consistency over a wide range of temperatures. Permagel's completely inorganic nature means there can be no solubility effects with changes in temperature. Permagel-bodied greases actually have no melting point and display good low temperature properties as well.

What does this suggest to you? One grade of grease for summer-winter operation? One grease instead of several for varying temperature applications? Lower inventory requirements? Lower grease costs?

Couple these advantages with Permagel's many other plus factors. Greases formulated with Permagel are unusually tough in high shear service, resist washout by water, and offer outstanding protection against corrosion. What's more, Permagel permits wide flexibility in formulation . . . helps insure grease reproducibility.

Let us help you find out why Permagel can be the ideal thickener for your multi-purpose greases. Sample and informative Bulletin P53 will be sent on request, and our considerable technical knowledge and formulation experience are at your disposal.

ATTAPULGUS DIVISION

Minerals & Chemicals Corporation of America

DEPT. S, 210 WEST WASHINGTON SQUARE, PHILA. 5, PA.

PERMAGEL

"only 240,773 more to fill before quitting time!"

A good day's work indeed! . . . and that amazing figure represents the number of barrels of liquid petroleum Cities Service refined every single day in 1953 . . . a total of 87,882,000 barrels! In that same year, the entire American petroleum industry produced 49.61 percent of all the crude oil produced in the world!

Obviously, the aggressive American petroleum industry is maintaining world leadership in this vital field and Cities Service, with its vast production, is an important contributing member of this great petroleum family.

We in the United States represent the largest users of petroleum products in the world but even more important is our position today as leaders of the free world. Only our great strength can assure that our world will stay free . . . and one of the most important segments of our freedom arsenal is the petroleum industry. Cities Service, one of the largest petroleum companies in the world, will continue to work toward finding new and better ways to serve the U. S. consumer . . . new and better ways to serve the cause of world freedom.

CITIES SERVICE

Gives white hot steel the "kid glove" treatment

GIGANTIC MACHINES with thousands of moving parts are used to shape white hot ingots into plates and sheets. All of these hard-working machine parts are subject to intense heat . . . normal in steel manufacturing. Because of the intense heat, lubrication is a serious problem.

U. S. Steel has tried various types of greases in order to eliminate the problem of oil burn-out. Now they're using a product of Shell Research, Shell Alvania Grease. Result: better lubricating action *at once*. Months after the original installations, rollers were removed and an excellent film of grease was still present.

At the other extreme, zero weather caused grease in an automatic lubricating system to congeal and become unpumpable. Shell Alvania was tried and clogging promptly stopped. This multi-purpose grease is now used extensively in low-temperature operations at U. S. Steel's Ohio Plant.

SHELL ALVANIA GREASE

- **resists oxidation**
- **will not squeeze out**
- **extends periods between overhauls**
- **provides exceptional lubrication in high or low operating temperatures.**

Shell Alvania Grease can cut down costly maintenance and save time and money in *your* plant. Write for technical information.

SHELL OIL COMPANY

50 WEST 50TH STREET
NEW YORK 20, NEW YORK

100 BUSH STREET
SAN FRANCISCO 6, CALIFORNIA

SHELL

Cost of Driving Questions Answered

"How much does it cost me to own and drive my car?" is a question which most of the nation's 67,000,000 passenger car owners ask themselves at one time or another. The volume of queries on this subject coming in annually to the AAA and its affiliated clubs indicates that most car owners ask the question for one of several reasons, including simple curiosity.

Some ask it to determine how much they should be reimbursed for use of their automobiles on company business. Others want the information to aid them in declaring expenses on income tax returns. And each year, still others use cost of car operation estimates in working up their vacation trip budgets.

A wide variety of methods are employed by companies which compensate employees for use of their cars on company business. These include:

Flat Mileage Allowance: Before World War II, a large number of companies granted flat mileage rates, usually from 5c to 6c a mile. Sharply rising postwar driving costs, however, made necessary a re-appraisal of such allowances, with the result that today almost three-fourths of companies using the flat mileage allowance reimburse their employees at 7c a mile or more. Emphasis is on the 7c allowance, with some 45 per cent of companies using this rate of compensation. Here are the current rates of flat mileage allowance usage as reported by the Dartnell Corporation of Chicago:

5 cents per mile	7%
6c	19%
6½c	2%
7c	45%
7¼c	3%
7½c	2%
8c	16%
9c	3%
10c	3%

A recent survey by Dartnell indicates that, despite certain shortcomings, a flat mileage allowance is the one most often used. Its principal disadvantage is that it often results in either over-compensation or under-compensation in comparison with actual operating costs involved. Its chief selling point, by comparison, is its simplicity—it is readily understood by the car owner and involves a minimum of bookkeeping and office control.

Because of its inherent inaccuracies, though, it is recommended that companies operating large fleets of automobiles consider a more elaborate system of compensation, particularly if the cars operate in different sections of the country.

Weekly Allowances: When cars are operated constantly on company business, a weekly allowance based upon mileage driven in varying types of territory has many advantages.

Combination Allowance: Certain annual fixed costs, such as insurance, license fees and depreciation are little affected by the mileage driven, while other expenses—gasoline, oil and tires vary directly with the number of miles driven. With this in mind, Runzheimer & Company, Chicago cost accounting firm, some years ago developed a formula which makes provision for these differing elements. Companies operating substantial fleets of employee-owned cars might find it advisable to contact this company for an individual allowance analysis.

For smaller operations or individual estimates, it is believed a formula based on the rough national averages in the Runzheimer cost figures will prove equitable. Such a formula would be:

Grant an allowance of $1.55 a day for each day that the car is driven on company business plus 3½c a mile for each mile driven on company business.

This Runzheimer formula is based on operating costs of the lighter cars—Ford, Chevrolet, Plymouth, etc. The costs of operating a heavier type of car certainly will be greater, but it remains a matter of decision with individual companies whether to grant additional allowances for such cars and whether the larger car actually is needed for the operation in question.

The most recent breakdown of car costs available is based on a national average of cost figures issued this year by Runzheimer. Following are cost figures for a car in the $2,000 price class, postwar models, driven up to 18,000 miles a year:

Variable Costs	*Average Per Mile*
Gasoline and Oil	2.29 cents
Maintenance	.74
Tires	.51
Total	3.54 cents

Fixed Costs	*Annual*
Fire and theft insurance	$ 17.90
Property damage and liability ($15,000 and $30,000)	85.18
License fees	16.64
Depreciation	446.59
Total	$566.31 a year (or $1.55 a day)

An allowance for up to $25 a year for repairs is made in the maintenance figure above. If repair costs run above that, the driver is justified in making an upward revision of cost in this department.

For annual mileages in excess of 18,000, Runzheimer recommends a special depreciation allowance averaging $10.66 per thousand miles driven over that figure.

And, since the variable costs cited above were computed on the basis of average driving speed, it should be remembered that as the driving speed increases so does the cost of operation.

By allowing a little leeway on the average mileage allowance above of 3.54c a mile in rounding it to 3.5c a mile, and by applying the fixed cost allowance of $1.55 a day, it becomes easy to compute the cost of operating a car over any given period of time and over any given mileage. A large number of motorists drive about 10,000 miles a year, which results in the following approximate costs:

10,000 miles @ 3.5 cents	$350.00
365 days @ $1.55	$565.75
Total	$915.75

or 9.16c per mile

In contrast, a car driven twice as far over the same period of time would cost the following:

20,000 miles @ 3.5c	$ 700.00
2,000 miles @ 10.66 per 1,000 over 18,000	21.32
365 days @ $1.55	565.75
Total	$1,287.00

or 6.43c per mile

And a car driven half as far throughout the year would cost:

Continued on page 46

Just Published!

Manufacture and Application of LUBRICATING GREASES

by C. J. Boner

Chief Research Chemist
Battenfeld Grease and Oil Corp.

Covers EVERY ASPECT of grease research, technology, and use!

1954
982 pages
$18.50

982
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IN THESE
23
BIG CHAPTERS

1 Introduction
2 Structure and Theory
3 Additives Other Than Structural Modifiers
4 Raw Materials
5 Manufacturing Processes
6 Equipment for Lubricating Grease Manufacture
7 Aluminum Base Lubricating Greases
8 Barium Base Lubricating Greases
9 Calcium Base Lubricating Greases
10 Lithium Base Lubricating Greases
11 Sodium Base Lubricating Greases
12 Lead Soap Lubricating Greases
13 Strontium Base Lubricating Greases
14 Miscellaneous Metal Soaps as Components of Lubricating Greases
15 Mixed Base Lubricating Greases
16 Complex Soap Lubricating Greases
17 Non-Soap Thickeners for Lubricating Fluids
18 Fillers in Lubricating Greases and Solid Lubricants
19 Residua and Petrolatums as Lubricants
20 Analysis of Lubricating Greases
21 Tests of Lubricating Greases and Their Significance
22 Application of Lubricating Greases
23 Trends in Lubricating Greases

Here in one giant volume . . . the most complete storehouse of information ever published on the composition, properties and uses of lubricating greases!

The book begins by describing in detail the structure and theory of lubricating greases. Then follow chapters on the various raw materials, processes and manufacturing equipment. Lubricants containing specific thickeners, including such recent developments as lithium soaps, complex soaps and non-soap gelling agents, receive special attention.

Of major interest is the large section on present uses and future trends of lubricating grease products. Here you'll find the complete details of when, where, and how to apply a specific lubricant for any given purpose.

Everyone concerned with the preparation or use of grease lubricants will find Boner's book of enormous practical value. Manufacturers and lubricating engineers will find here a complete breakdown of the effects of each ingredient or treatment upon the characteristics of the final product, and a full explanation of the physical and chemical methods used in measuring these characteristics. Suppliers of fats, oils, additives, thickeners and other raw materials will gain new ideas for future product research and development. In addition, users of grease products will learn the properties of available lubricants and the major purposes that each fulfills.

MAIL THIS HANDY ORDER COUPON TODAY!

NLGI SPOKESMAN
4638 J. C. Nichols Parkway
Kansas City 12, Missouri

Please rush me a copy of Boner's MANUFACTURE AND APPLICATION OF LUBRICATING GREASES.

☐ I am enclosing $18.50
☐ Please bill me

NAME _____

ADDRESS _____

CITY & ZONE _____ STATE _____

The "HIDDEN ASSET" that makes the grease – METASAP* ALUMINUM STEARATE BASES

The user cannot see it by looking in the container, but when he finds a lubricant doing an outstanding job, it's 2 to 1 a Metasap Aluminum Stearate Base is incorporated therein.

For Metasap Aluminum Stearates are today's *foremost* development in grease making. Lubricants made with them are moisture-proof, temperature-resistant, water-repellent . . . clear and uniform . . . able to perform superlatively under the tougest conditions.

Whatever your grease requirements, call upon Metasap – and profit by being able to meet every specification with the best possible grease for the job.

*REG. U. S. PAT. OFF.

METASAP CHEMICAL COMPANY, HARRISON, N. J.

BRANCHES: BOSTON • CHICAGO • CEDARTOWN, GA. • RICHMOND, CALIF.

Stocks at Cleveland and Akron, Ohio; Los Angeles and San Francisco, Calif.; Louisville, Kentucky

METASAP CHEMICAL COMPANY *REG. U.S. PAT. OFF.

Stearates

of Calcium • Aluminum • Lead • Magnesium • Zinc

Cost of Driving

Continued from page 43

5,000 miles @ 3.5c $175.00
365 days @ $1.55 ..... 565.75
$740.75

or 14.8c per mile

It is evident from the examples above that since the fixed costs decrease in proportion to the total mileage driven over a given period of time, the cost of operation for higher mileages is proportionately less.

Any estimate of driving costs should take into consideration the recognized added expense of driving in congested urban traffic. While data on the actual percentage increase in cost is slight, at least two estimates have come to the attention of the AAA.

The Los Angeles city government recently computed on the basis of urban studies, that operating costs in congested areas are 15% above normal costs. Thus, with the cost of car operation at, roughly 3.5c a mile, an additional 15% allowance will bring the cost of driving in crowded areas to over 4c a mile. Certain fixed costs such as insurance and depreciation are likely to run higher in localities with traffic tangles and much "stop and go" movement.

In travel time and gasoline consumption studies in Boston in the summer of 1951, authorities also found that gasoline mileage obtained appears to tie in pretty directly with slow speeds in congested traffic. Said Dr. A. J. Bone, on the studies:

"In the lower range of speeds, below 10 miles per hour, *when the speed of the vehicle is controlled by the density of traffic*, a fairly close relation does appear to exist between gasoline consumption and speed."

Comparative figures excerpted from the Bone report, showing mileage per gallon obtained at various urban traffic speeds covered in the study, follow:

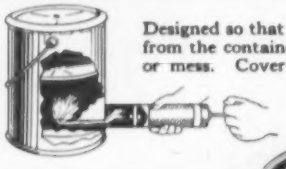
At 4 miles per hour, the motorist obtained 5 miles per gallon.

At 5.5 miles per hour, the motorist obtained 7 miles per gallon of gasoline.

At 9 miles per hour, the motorist obtained 10.6 miles per gallon of gasoline.

Step up your
GREASE SALES
to the
FARM MARKET
with the improved G.P.&F.

E-Z-FILL
GREASE GUN LOADER PAIL



Designed so that grease gun can be filled directly from the container quickly, easily with no waste or mess. Cover of the pail is never removed. Grease can't get dirty. Air pockets cannot be formed in gun.

● Now E-Z-FILL Grease Gun Loader Pails are made stronger than ever. Heavy 24-gauge steel body adds more protection for your product . . . enables the filled pail to be shipped *without repacking it in a corrugated carton!* Leakproof, easier-to-use sockets are another new feature. Available in 25-and-35-pound sizes in solid colors or lithographed with your own design.

G.P.F. STEEL CONTAINERS
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CORRECT
LUBRICATION

SOCONY-VACUUM

Makers and Marketers of
Mobil
Automotive
Oils and Greases
Gargoyle
Industrial
Oils and Greases

SOCONY-VACUUM OIL CO., INC., and Affiliates:
MAGNOLIA PETROLEUM COMPANY
GENERAL PETROLEUM CORPORATION

PROGRESS THRU RESEARCH . . . at GENERAL MILLS

General Mills Fatty Acids Cut Gum Formation ☆☆☆☆☆ Trace-Metal Contaminants Removed ☆☆☆☆☆ Composition is Uniform

Greases for heavy transport equipment must lubricate under all conditions, in all types of weather, without gumming up. Oxidative stability is an important consideration for such lubricants.

Suppose you went to the doctor . . . feeling like a left-over hamburger . . . and he said, "Here, take this medicine. It may not help you much, but it's cheap." Sounds strange, doesn't it. But maybe you do almost the same thing when you use fats not prescribed to cure your grease production ills.

Grease Oxidation, for instance, is a common problem which is frequently attributed to an excessive quantity of polyunsaturated fatty acids—fast oxidizing, gum-formers such as linoleic and linolenic acids. Recognition of this problem, causes General Mills to select and process raw materials in such a manner that the Aliphats (fatty acids) contain a minimum amount of oxidizable impurities.

The Aliphats are also processed so that minimum amounts of trace-metal contaminants such as copper and nickel, remain.

It has also been found that for a given iodine value, fatty acids make greases which oxidize slower than those made from tallow. Conversely you can use cheaper fatty acids of higher iodine value to get grease with equal oxygen stability.

That's why many grease makers use all or part fatty acids in compounding oxygen-stable greases. They keep cost down, but get a substantially more stable lubricant.

☆☆☆☆☆

Uniformity and Light Color make General Mills Aliphat (fatty acid) 26-C a favorite with lime grease makers. Its high stearic acid content, compared to mixed animal fats, boosts the yield of calcium greases. This whole distilled grade of animal fatty acids contains all the acids that occur in natural tallow, but the glycerine and mucilaginous impurities have been removed.

Then, there are other fatty acids designed for your specific needs. There are fractionally distilled animal fatty acids (Aliphats 26-A and 26-B); fractionally distilled palmitic-stearic fatty acids (Aliphats 6-B and 6-C); a fractionally distilled mixed vegetable fatty acid (Aliphat 46-C); a distilled cottonseed fatty acid (Aliphat 33-L); and many more. General Mills also supplies hydrogenated tallow glycerides for grease manufacturing.

☆☆☆☆☆

Perhaps Best Of All the prices of General Mills fatty acids are attractively low—especially when you consider higher yields and productivity of plant equipment and manpower.

You can use less fat by substituting more reactive General Mills fatty acids, either completely or in combination with whole fats. You can adjust the fatty acids to give you proper balance for a superior product and yield.

In short, use fatty acids that have been processed to remove diluents, impurities and other sources of instability; uniform acids that can be mixed in ratios that offer the most benefit for you. That means General Mills Aliphats.

For technical information on General Mills grease-making fatty acids, write today on your letterhead, or mail the coupon below.

SEND THIS COUPON

PROGRESS THRU RESEARCH

☆☆☆☆☆ **General Mills** **CHEMICAL DIVISION**
KANKAKEE, ILLINOIS

Please send me technical information for the General Mills grease making fatty acids checked below.

Aliphats (fatty acids):

☐ 6-B	☐ 26-B	☐ 33-L
☐ 6-C	☐ 26-C	☐ 46-C
☐ 26-A	☐ Hydrogenated Tallow Glycerides	

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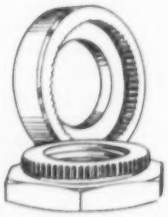
No longer has to take the blame for bearing failure due to faulty adjustment



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Makes possible perfect wheel bearing adjustment

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Whether it's greasing junior's racer, or a mighty locomotive, DEEP ROCK has greases and lubricants that fill the bill. Let DEEP ROCK's ultra-modern refining facilities supply you today!

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OIL CORPORATION

Atlas Life Bldg. Tulsa, Oklahoma

New Centralized Lubrication System

Automatic application of fluid lubricants to bearings on individual industrial machines at predetermined intervals is provided by a new air-operated centralized lubrication system, recently announced.

This system was developed, according to the manufacturer, to fulfill the need for servicing machines operating at varying rates of speed where applications of lubricant at varying intervals may be required, as the case may be—also, for the lubrication of automated machine lines, permitting interchangeability of machine units without disturbing the lubrication system.

Control may be by any one of three methods: Mechanical Control—utilizing motion of the machine to actuate an air valve which in turn cycles the lubrication system; Electrical Control—utilizing an adjustable time clock to actuate a solenoid air valve which in turn cycles the lubrication system at intervals of 7½ minutes to 3 hours; and Manual Control—utilizing an air valve actuated at machine operator's discretion.

The system includes an automatic safety control which stops the machine if air supply to pump fails, lubricant reservoir is empty or lubricant supply line is damaged.

For complete details write for free brochure No. 806 from the manufacturer, Lincoln Engineering Company, Industrial Division, 5702-30 Natural Bridge Avenue, St. Louis 20, Missouri.

Continental Can Grows

The legal closing of the sale of American Paper Goods Company of Kensington, Conn., to Continental Can Company was announced recently by General Lucius D. Clay, Continental's chairman of the board.

Continental's offer to purchase the assets and properties of American Paper Goods was approved by stockholders of the Kensington company last month. The two American plants at Chicago, Ill., and Kensington, Conn., will be operated as a part of Continental's paper container division.

*

The investment of the oil and gas industry in tools and facilities is estimated at $43 billion dollars, enough money to buy the Pentagon 518 times.

REPUBLIC STEEL PAILS AND DRUMS

for Oils, Greases, etc.

No. 9 pail with lug cover and choice of pour spouts for 5 gallons oil or 35 pounds grease.

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Fabricated from black steel—outside painted or lithographed to order. Removable tops with lug covers, with or without pour spouts.

100 lb. or 120 lb. grease drum with 14 inch full open-top lug cover. Also made with 9 inch lug cover in center of head; offset bottom for stacking.

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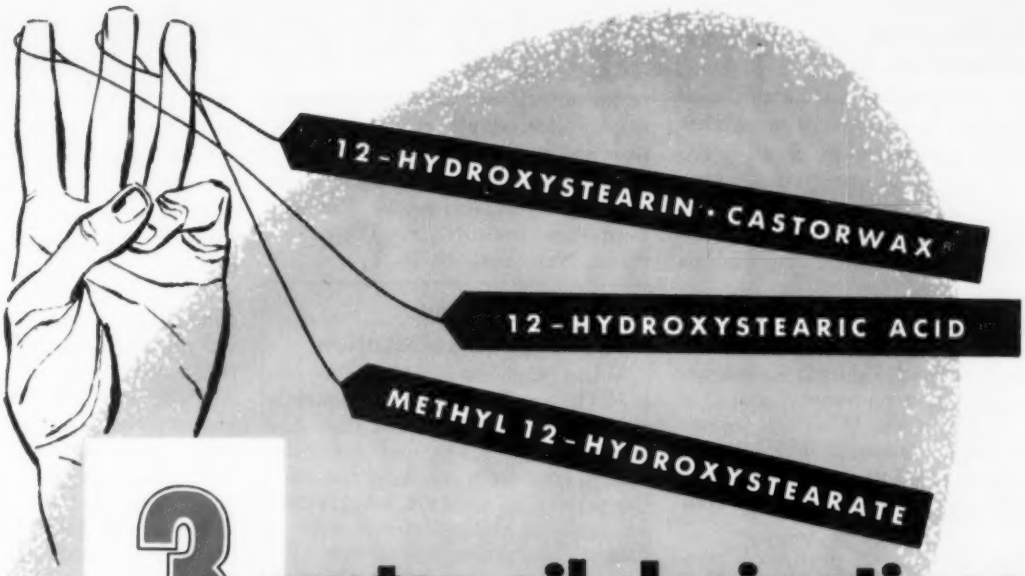

3 castor oil derivatives

for the Grease Compounder

The world's largest supplier of Castor Oil and Castor Oil Derivatives offers three reactive sources of 12-Hydroxystearic Acid, all Baker products from the Growing Field to the Hydrogenated Oil Derivative. Our 97 years of continuous experience in the manufacture and sale of Castor Oil chemicals insures you **availability, quality** and **service.**

Your inquiries are solicited for samples and technical literature.

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LOS ANGELES • CHICAGO

API Announces New Booklet

To keep pace with the statistics of a business that employs more than 1,600,000 persons and produced 2,360,000,000 barrels of crude oil last year, the American Petroleum Institute has issued the 11th Edition of its "Petroleum Facts and Figures," the Institute has announced.

H. B. Miller, API director of information, pointed out that 'Petroleum Facts and Figures" is designed to be the most convenient source of information available on the nation's third largest industry. The oil business is exceeded in size only by agriculture and all public utilities combined.

This year the 322-page book tabulates statistics of every phase of the oil industry for the years 1949-1953.

When used with the 9th Edition, with its coverage of the oil industry prior to World War II, this 11th Edition will provide one of the most complete statistical reviews available for any industry.

The new publication adds such features as flow charts showing movement of the principal petroleum products from refinery to consumer, tables on offshore drilling operations, employment, employee earnings, and pipe line mileage tabulations.

This basic reference work may be obtained for $2.00 from the American Petroleum Institute, 50 West 50th Street, New York 20, N. Y.

Business Machines Require Good Lubrication

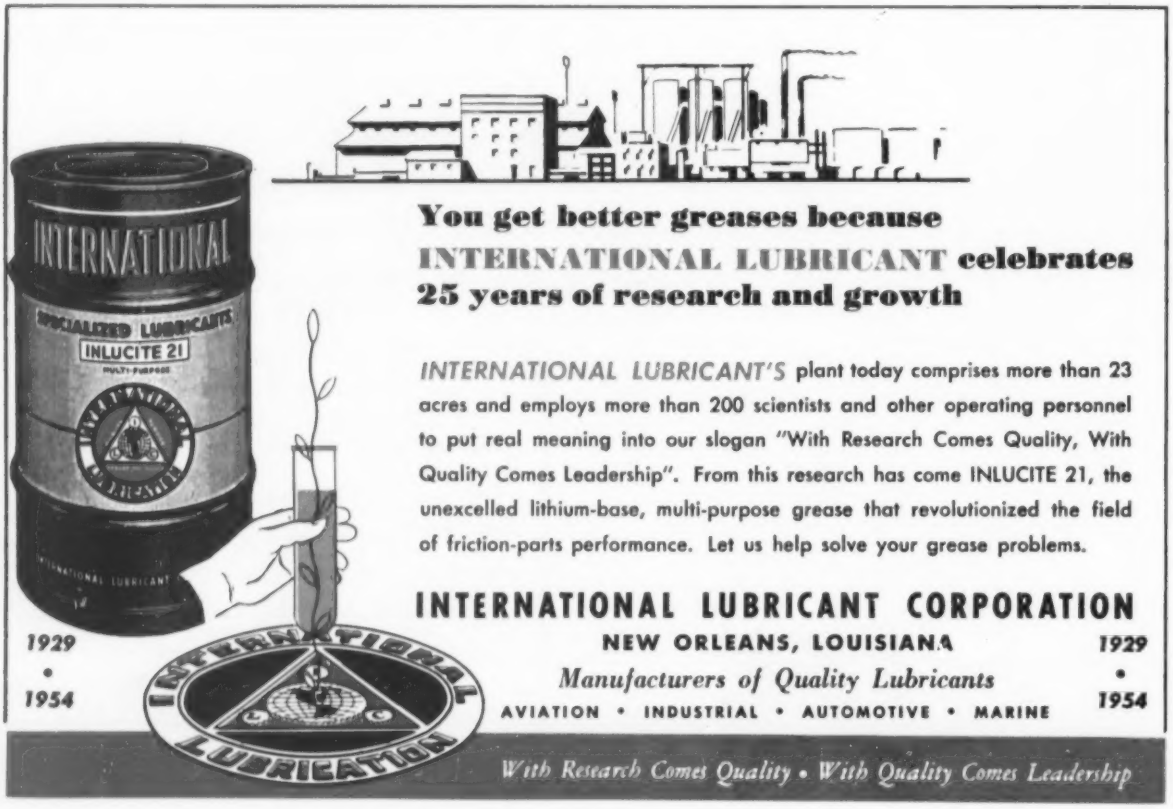
When business machines are exposed to the temperatures frequently experienced in most offices, they tend to throw off pre-thinned lubricants from motor shafts and other fast-moving parts. This situation is aggravated by machines heating up as a result of continuous, prolonged service. The net effect is unsatisfactory lubrication, messy machines, and often damage to other equipment or to garments.

Service personnel for a leading business-machine manufacturer suggest the use of a colloidal graphite dispersion, Oildag Concentrated, mixed with petrolatum. The petrolatum adheres tenaciously to moving parts under all normal extremes of operating conditions while Oildag, a product of Acheson Colloids Company increases its lubricity. Acheson's concentrated dispersion contains 10% solids by weight of colloidal graphite in a petroleum-oil carrier.

The 2% mixture of Oildag in petrolatum—approximately two ounces per gallon—is swabbed on motor shafts and other high-speed components. The colloidal graphite is carried to all parts and provides a clinging, graphited surface which resists the effects of heat. Rubbing parts are given much longer life, and they run better without requiring attention.

Not only does superior lubrication result, but the blending procedure is much cleaner, quicker, and easier than for such lubricant mixes as graphite powder and petrolatum thinned with pine oil.

Where a white lubricant is required, another Acheson product, dag Dispersion No. 172, can be used. This is a suspension of zinc oxide in white oil, and can likewise be blended into petrolatum or diluted with other oil vehicles.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You get better greases because
INTERNATIONAL LUBRICANT celebrates
25 years of research and growth
INTERNATIONAL LUBRICANT'S plant today comprises more than 23 acres and employs more than 200 scientists and other operating personnel to put real meaning into our slogan "With Research Comes Quality, With Quality Comes Leadership". From this research has come INLUCITE 21, the unexcelled lithium-base, multi-purpose grease that revolutionized the field of friction-parts performance. Let us help solve your grease problems.
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NEW ORLEANS, LOUISIANA
Manufacturers of Quality Lubricants
AVIATION • INDUSTRIAL • AUTOMOTIVE • MARINE
1929 • 1954
1929 • 1954
INTERNATIONAL LUBRICATION
With Research Comes Quality • With Quality Comes Leadership

FUTURE MEETINGS of the Industry

DECEMBER, 1954

27-30 American Association for the Advancement of Science, University of California, Berkeley, Calif.

JANUARY, 1955

10-14 Society of Automotive Engineers (golden anniversary annual meeting), The Sheraton-Cadillac Hotel and Hotel Statler, Detroit, Michigan

20-21 National Industrial Conference Board, Hotel Astor, New York, N. Y.

FEBRUARY, 1955

13-18 ASTM Committee D-2 on Petroleum Products and Lubricants, Rice Hotel, Houston, Texas.

15-17 Texas Oil Jobbers Assn. (management institute), Driskill Hotel, Austin, Texas

16-17 American Petroleum Institute (Division of Marketing, Lubricating Committee) Sheraton-Cadillac Hotel, Detroit, Mich.

MARCH, 1955

15-17 Ohio Petroleum Marketers Association (spring convention and trade exposition), Deshler-Hilton Hotel, Columbus, Ohio.

17-19 Texas Oil Jobbers Assn. (annual convention and trade exposition), Gunter Hotel, San Antonio, Texas

24 National Industrial Conference Board, Shamrock Hotel, Houston, Texas

APRIL, 1955

11-15 Greater New York Safety Council (annual convention and exposition), Statler Hotel, New York, N.Y.

13-15 American Society of Lubrication Engineers (tenth annual meeting and lubrication exhibit), Hotel Sherman, Chicago, Illinois.

MAY, 1955

9-12 American Petroleum Institute (Division of Refining, midyear meeting), Jefferson Hotel, St. Louis, Mo.

16-18 American Petroleum Institute (Division of Marketing, Lubrication Committee), The Greenbrier, White Sulphur Springs, W. Va.

16-18 American Petroleum Institute (Division of Transportation, Products Pipe Line Conference), Edgewater Beach Hotel, Chicago, Ill.

19-20 National Industrial Conference Board, Waldorf-Astoria Hotel, New York, N. Y.

23-25 American Petroleum Institute (Division of Marketing, midyear meeting), Chase and Park Plaza Hotels, St. Louis, Mo.

JUNE, 1955

6-15 Fourth World Petroleum Congress, Rome, Italy.

12-17 SAE Golden Anniversary Summer Meeting, Chalfonte Haddon Hall, Atlantic City, N. J.

26 to July 1 American Society for Testing Materials (annual meeting), Chalfonte-Haddon Hall, Atlantic City, N. J.

OCTOBER, 1955

23-25 National Assn. of Oil Equipment Jobbers (4th annual meeting), Hotel President, Kansas City, Mo.

31 to Nov. 2 NLGI ANNUAL MEETING, EDGEWATER BEACH HOTEL, CHICAGO, ILL.

NOVEMBER, 1955

14-17 American Petroleum Institute (35th annual meeting), San Francisco. Calif.

JUNE, 1956

17-22 American Society for Testing Materials (annual meeting), Chalfonte-Haddon Hall, Atlantic City, N. J.

9 grades of Swift's LAREX serve specific lubricating needs

Tallow Fatty Acid #42
Fatty Acid #35 & #86
Hydrogenated Tallow & Marine Glycerides
Hydrogenated Castor Oil
Stearic Acids
Red Oils (Oleic Acid)
Hydrogenated Tallow & Marine Fatty Acids
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Acidless Tallow
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● Yes, we are familiar with the edible uses of pork when the pig goes to market the first time. But a part of Swift's pigs go to market *again* as Larex, to serve many industrial uses such as in cutting oils, fine lubricants and in metal stamping; for sulfurizing, additives, for mold release agents and others.

Just as your products depend on the quality of the raw materials used, lard oils depend on the quality of pork fat used. All of these porkers provide Swift & Company *first choice* from a wide selection of quality raw materials.

To you this means, that when you buy Larex, you can choose from 9 grades to fill the most ordinary . . . or most critical of your lard oil needs.

All of Swift's products, which serve the lubricating industry, are backed by a sales and research organization that, like you, are constantly seeking better, more economical means of producing lighter color, more uniform lubricants.

Swift & Company has specialized in processing a full line of fats and oils for the lubricating industry. Write for the new 8 page bulletin describing the products listed at left and remember . . .

ONE TRIAL IS BETTER THAN A THOUSAND CLAIMS

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THIS MAY BE YOUR CURVE, TOO, WHEN YOU USE THIS NEW GELLING AGENT
TONS OF BENTONE* 34 SOLD
ACTUAL SALES OF BENTONE* 34, BY WEIGHT, 1951-1954

MORE AND MORE GREASE COMPOUNDERS ARE CHANGING TO BENTONE* 34

Year after year the climbing sales of Bentone* 34 continue, as leading grease compounders see how easy it is to use this non-soap gelling agent. Its remarkable ability to withstand heat without melting, its excellent adhesion to moving metal parts, and its resistance to washing, are only three reasons why grease makers and users alike are changing to lubricants gelled with Bentone* 34.

Easily compounded with lubricating oil by milling in a standard commercial colloid mill or homogenizer, Bentone* 34 produces a multi-purpose, non-melting grease. Production of Bentone* 34 lubricants requires low investment in equipment and produces a grease of consistent high quality at low thickening cost. If you are not now one of the many firms making Bentone* 34 greases, write today for complete technical details.

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BENTONE* 34
THE NON-SOAP GELLING AGENT

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to tell our steel container story

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A Primer on the Key Ingredient for Multi-Purpose Greases

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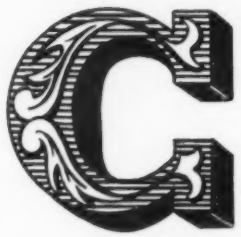
Vast domestic reserves of lithium ore coupled with expansion of Foote's production unit at Sunbright, Va.—the world's largest lithium chemical plant—these are your assurance of an abundant supply of lithium for your needs.

BASIC

Lithium hydroxide is the accepted ingredient that makes possible the production of a single lubricating grease that resists cold, heat and moisture.



CONSISTENT QUALITY

You can depend on the chemical and physical uniformity, and stability of Foote lithium hydroxide.

Don't delay. Write for the facts about the economies of Foote lithium hydroxide.

Today as always
Foote maintains

LEADERSHIP IN LITHIUM

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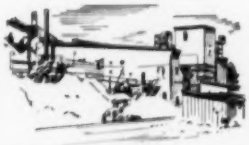

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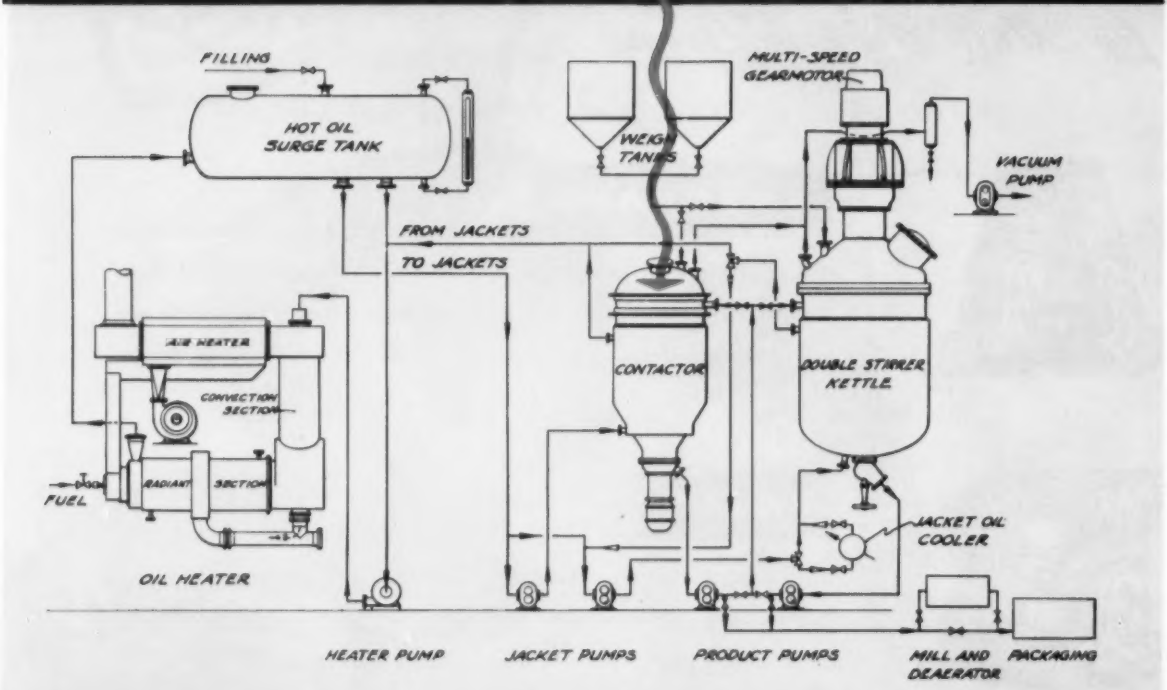
The STRATCO contactor



and How It Simplifies Grease Making

• Now standard equipment in many other processes, the Stratco contactor also is primarily responsible for the comparative simplicity, efficiency and economy of Stratco grease making installations.

As a highly efficient mixer the Stratco contactor provides continuous or batch mixing with very short time cycles. It makes possible the production of more uniform greases with less soap and with simplified laboratory control. It replaces other types of equipment and simplifies plant layout; makes possible either increased production or fewer man hours of operation.

A complete Stratco plant layout is illustrated above. Equipment is adaptable to modernization programs as well as to new installations. Write for details.

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